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Abstract: Consumption of oat and buckwheat have been associated with various health benefits that may be attributed to their nutritional composition. We performed a systematic review to evaluate the profile and quantity of bioactive compounds present in oat and buckwheat. Among 154 studies included in final analysis, 113 and 178 bioactive compounds were reported in oat and buckwheat, respectively. Total phytosterols, tocols, flavonoids and rutin content were generally higher in buckwheat, β-glucans were significantly higher in oat, while avenanthramides and saponins were characteristically present in oat. The majority of studies included in current review were published before 2010s. The heterogeneous methodological procedures used across the studies precluded our possibility to meta-analyse the evidence and raises the need for harmonization of separation and extraction methods in future studies. Our findings should further stimulate the exploration of metabolites related to identified phytochemicals and their roles in human health

Highlights

- Oat and buckwheat are good sources of micro- and macronutrients and bioactive phytochemicals, with 113 and 178 phytochemicals reported respectively.
- Compared to oat, total phytosterols, tocols, flavonoids and rutin content were generally higher in buckwheat.
- β-glucans were significantly higher in oat while avenanthramides and saponins were characteristically found in oat.
- Proper food transformation might be a prerequisite to preserve nutritional content of oat and buckwheat.
- Bioactivity and bioavailability of oat and buckwheat`s phytochemicals and their health effects need further investigation.

A Systematic Review of Phytochemicals in Oat and Buckwheat

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ABSTRACT

Consumption of oat and buckwheat have been associated with various health benefits that may be attributed to their nutritional composition. We performed a systematic review to evaluate the profile and quantity of bioactive compounds present in oat and buckwheat. Among 154 studies included in final analysis, 113 and 178 bioactive compounds were reported in oat and buckwheat, respectively. Total phytosterols, tocols, flavonoids and rutin content were generally higher in buckwheat, β-glucans were significantly higher in oat, while avenanthramides and saponins were characteristically present in oat. The majority of studies included in current review were published before 2010s. The heterogeneous methodological procedures used across the studies precluded our possibility to meta-analyse the evidence and raises the need for harmonization of separation and extraction methods in future studies. Our findings should further stimulate the exploration of metabolites related to identified phytochemicals and their roles in human health.

Key words: oats; buckwheat; phytochemicals; bioactives; systematic review

1. INTRODUCTION

Cereal grains are the major source of energy and an important constituent of diet for millions of people worldwide (Gangopadhyay, *et al.*, 2015); however, the majority of acreage dedicated to growing cereal crops throughout the world produce wheat, rice, and maize (Food and Agriculture Organization, 2003). This translates into consumption patterns that favor these crops over the other cereals, such as oat (*Avena sativa L*) and buckwheat (*Fagopryum esculentum Monch*), that are less often cultivated worldwide.

Oats and buckwheat grains are unique due to their blend of macro, micro, and phytonutrientsand their consumption have been associated with various health benefits including reduced risk of cancer, obesity, diabetes and cardiovascular diseases (CVD)(Borneo & Leon, 2012; L Li, *et al.*, 2018; Rasane, *et al.*, 2015). The observed health benefits have been attributed to their high content of dietary fibers such as β-glucan, functional protein, essential fatty acids, vitamins, and antioxidant phytochemicals, including high phenolic compounds (Flander L, 2007; Gangopadhyay, *et al.*, 2015). Due to its well-balanced nutritional profile, oat is one of the most important cereal crops in the developed world. Compared with other cereals, oats have higher concentrations of certain nutrients and phytochemicals and can tolerate harsher growing conditions, such as wet climate and acidic soil, making them more resilient than other crops (Grundy, *et al.*, 2018). Similarly, buckwheat, besides high starch content, is also rich in protein with a well-balanced amino acid profile, dietary fiber, lipids, and minerals, along with other components such as phenolic compounds and sterols (Ahmed, *et al.*, 2014; Krkoskova & Mrazova, 2005). Due to low gluten content, both oat and buckwheat are suggested to be suitable substitutes for wheat, barley, and rye in gluten-sensitive patients (Arendt & Zannini, 2013).

Recent studies suggested important differences in major phytochemical content between oat and buckwheat (Dar, *et al.*, 2018; Keriene, *et al.*, 2015; Yu, *et al.*, 2018). Previous attempts to review the literature on the phytochemical content of oat (Boz, 2015; Gangopadhyay*, et al.*, 2015; Sang & Chu, 2017) and buckwheat(Ahmed*, et al.*, 2014; Zhan-Lu*, et al.*, 2012), were not systematic, did not report the quantities of compounds identified, and did not directly compare phytonutrients between the two cereals. Advancing the understanding of the two grains together can facilitate comparisons between oats and buckwheat, help support the utilization of the two grains for consumer products, and justify their combination in future studies. Thus, this systematic review of the literature aims to evaluate and compare the profiles and quantities of phytochemicals commonly found in oat and buckwheat, and to explore the potential of incorporating these two plants into human diets for optimal health and provide perspectives for further investigation. We hope the present systematic review will help present the two plants as a good option for growers to consider for their reported phytochemical contents and associated health benefits, and the benefit of a more diverse set of crop cultivation from our current mono-crop centric society.

2. METHODS

2.1 Literature search

This review was conducted following a recently published guideline on how to perform a systematic review (Muka*, et al.*, 2020), following the PRISMA guidelines (Moher*, et al.*, 2009) (Supplemental Table 1) and in accordance with the review protocol. Four bibliographic databases (PubMed, Embase, Web-of-Science, and Cochrane Central Register of Controlled Trials) were used to identify published studies until June 1, 2020 (date last searched) that examined the nutrient and bioactive composition of oat and buckwheat. The search terms we used were related to nutrient and bioactive compounds (e.g., nutrients, metabolism, phytochemical, carbohydrate, fatty acids) and the plants (oat and buckwheat) (Supplemental Table 2). We did not apply any restrictions on language and date. However, we excluded conference abstracts, letters to the editor and editorials. To retrieve additional publications, we checked the reference lists of studies included in the current review.

2.2 Study selection criteria

Studies were included if they met the following inclusion criteria: (i) used samples of oat and/or buckwheat; and (ii) evaluated nutrient and bioactive compounds. Two reviewers independently assessed the titles and abstracts according to the selection criteria. For each potentially eligible study, two reviewers assessed the full-text articles. In cases of disagreement, the decision was made by consensus, or, if necessary, a third reviewer was consulted.

2.3 Data extraction

Two reviewers extracted data independently using a predesigned form, including first author and publication year, plant's source, compound name, and concentration, as reported in the articles.

3. RESULTS

After searching the following electronic databases PubMed, Embase, Web of-Science, and Cochrane, 3,250 potentially relevant citations were identified, and after removing 817 duplicates, 2,433 abstracts and titles were evaluated according to inclusion and exclusion criteria (Figure 1). Full texts and reference lists of 201 studies were evaluated, among which 154 studies were eligible to be included in the current review. In the 154 included studies (oat n=72 and buckwheat n=83), 113 phytochemicals and metabolites were reported in oat and 178 in buckwheat, which we discuss in detail in the later sections. The list of all phytochemicals reported in oat and buckwheat and the references can be found in Table 1&2, while detailed information on phytochemical concentrations can be found in Supplemental Table 2 & 3. An illustrative summary of the most important findings is presented in Figure 2.

3.1 Phenolic Compounds

Phenolic compounds consist of one or more aromatic rings, bearing one or more hydroxyl groups, and are generally categorized as flavonoids, phenolic acids, stilbenes, polyphenolic amides (e.g., avenanthramides), coumarins, and tannins (Ahmed*, et al.*, 2014). Details on phenolic compounds identified in oat and buckwheat are summarized in Table 1 &2 and Supplemental table 3.

3.1.1. Flavonoids

Flavonoids (flavonols, flavones, flavanols, flavonones, flavans, and anthocyanins) are phenolic compounds, which comprise more than 4000 polyphenolic complexes (Tanwar & Modgil, 2012). In total, 16 and 64 flavonoids were reported in oat and buckwheat, respectively, and those are listed in Table 1 & 2 and Supplemental Table 2. Total flavonoid content ranged from 6 mg of rutin equivalents (RE)/100g in groat to 3,149 mg RE /100g in unfermented buckwheat sprouts (Chen*, et al.*, 2018; XD Guo*, et al.*, 2011; Peng*, et al.*, 2017; Sedej*, et al.*, 2012). Tartary buckwheat had a higher content of total flavonoids in comparison with common buckwheat, with an indication that this difference decreases during germination (Fabjan*, et al.*, 2003; Jiang*, et al.*, 2015; Tien*, et al.*, 2018). Rutin was a predominant flavonoid compound detected in buckwheat. Although its content was high in all morphological parts of buckwheat, its highest content was observed in buckwheat leaves (maximum 3,417 mg/100g) and bran (maximum 5,186mg/100g)(Habtemariam, 2019). Rutin levels were also up to 5-fold higher in tartary in comparison to common buckwheat (Y Liu*, et al.*, 2019). Lower concentration of rutin was also reported in husked oat fractions (0-3.2 mg/100g) and oat seeds (0.22-0.47 mg/100g) (Keriene*, et al.*, 2015; Tong*, et al.*, 2014). Other flavonoids such as vitexin, isovitexin, orientin, and isoorientin were generally more abundant in common buckwheat. Quercetin was the predominant flavonoid compound in oat with husked oat samples having the highest concentration (up to 8.9 mg/100g) (Keriene*, et al.*, 2015). In common buckwheat, quercetin concentrations ranged from 0.07 mg/100g in the hull to 33 mg/100g of buckwheat sprouts with tartary buckwheat seeds reaching the levels as high as 291 mg/100g (XD Guo*, et al.*, 2011). In general, a wide range of variations of flavonoids among buckwheat and oat cultivars was linked with the variety, environmental factors, growing conditions, time of harvest, processing techniques and anatomical part of the plant used(Fabjan*, et al.*, 2003; XD Guo*, et al.*, 2011; B. D. Oomah & G. Mazza, 1996; Tong*, et al.*, 2014).

Fagopyrin, flavonoid potentially harmful to human health, was mostly reported in buckwheat sprouts and ranged from 0.0025% to 0.041% and from 0.10% to 0.12 % in common and tartary buckwheat sprouts respectively; while in another study its concentration ranged from 19 to 32 mg/100g of common and tartary buckwheat leaves and flowers respectively (Habtemariam, 2019; Kreft*, et al.*, 2013). Kreft at al, however, suggest that the consumption of approximately 40 sprouts (0.14 g of dry mass sprouts per kg of body mass per day) may not cause phototoxic effects. The intake of 10 g of dry mass (or approximately 30 g of fresh mass) of buckwheat sprouts may, on the other hand, cause health problems (such as dermatitis and hair loss). Yet, the authors warn that the toxic dose may vary depending on exposure to sunlight, body mass, and age (Kreft*, et al.*, 2013).

3.1.2. Polyphenolics

Total phenolic content in oat varied from 35.1 to 576 mg of mg/100g with oat bran concentrate having the highest content. In buckwheat, total phenolic content was expressed in gallic acid (GAE) or rutin (RE) equivalents reaching 670 GAE mg/100g in buckwheat seeds and sprouts, and 1,410 mg RE mg/100g in common buckwheat husks. In general, oat bran, hulls, and groats had the highest total phenolic content. Only two studies directly compared the total phenolic content in oat and buckwheat. Buckwheat husks and grain with husks had 2 to 5-folds more phenolic compounds in comparison to oats samples, as expressed in RE (Supplemental Table 2). In line with this, in another study comparing the GAE in both plants, the buckwheat had higher total phenolic content (330.3-3.951.4 mg GAE/100g) in comparison to oat (113.8 mg GAE/100g)(Holasova*, et al.*, 2002). Due to differences in units of measurements used, we were not able to compare findings from other studies. A study directly comparing total phenolic content in tartary and common buckwheat reported higher total phenolic content (667 mg GAE/100g) in tartary buckwheat in comparison to common buckwheat seed samples (537 mg GAE/100g) (Y Liu*, et al.*, 2019). In addition, the aerial extracts were richest in total phenols followed by the stem and the seed-buckwheat extracts (A. R. Gulpinar*, et al.*, 2011; Holasova*, et al.*, 2002). Nine phenolic acids were quantified in both oat and buckwheat samples: p-hydroxybenzoic and dihydroxybenzoic acid, caffeic, p-coumaric, ferulic, vanillic, sinapic, gallic, and syringic acid (Table 1&2). The most abundant phenolic acid in oat was ferulic acid, which levels reached 149.36 mg/100g in oat grain (Kovacova & Malinova, 2007). While p-anisic (also known as 4-methoxybenzoic acid) acid was the most abundant phenolic acid in buckwheat and its levels reached 1,190 mg/100g followed by vanillic acid which content reached 311.7mg/100g (Dziedzic*, et al.*, 2018; Sytar, 2015). All polyphenolic compounds identified in oat and buckwheat are listed in Tables 1 & 2. Different solvents extraction methodology may explain differences in the extraction efficiency of phenolic compounds found in the current review. For example, Dziedzic et al., found that the sum of phenolic compounds obtained from different morphological parts of buckwheat (seed, flower, root) using methanol was higher than compounds extracted using water (Dziedzic*, et al.*, 2018). Besides differences caused by solvents used, across the studies, different cultivars, genetic varies, and growing conditions were used, additionally affecting our findings. Indeed, all thermal treatments led to losses of total phenolic acid concentration in the common buckwheat samples, the greatest losses were observed with microwaving (−51.9%), followed by roasting (−33.3%), steaming (−23.5%) and boiling (−10.5%). Yet, an increase in certain phenolic acids was also noted: roasting resulted in a 3.56-fold higher concentration of syringic acid compared to the raw common buckwheat samples. Boiling and steaming caused a slight increase in p-hydroxybenzoic acid and vanillic acid+caffeic acid and p-coumaric acid+syringaldehyde, respectively (Y Liu*, et al.*, 2019).

3.1.3 Avenanthramides

Avenanthramides (AVAs) are a group of unique, low-molecular-weight hydroxycinnamoyl anthranilate alkaloids uniquely present in oats. AVAs, besides affecting the flavour of oat products, have been reported to improve health parameters in animal and human studies. They have antiproliferative, antioxidant, anti-inflammatory, and anti-atherogenic properties (Leonova*, et al.*, 2008; Steadman*, et al.*, 2001; R. W. Welch, 1975).

In the current review, the amount of total AVAs in oats ranged from 0.5 mg/100g to 71.85 mg/100g (Chen*, et al.*, 2018; Horbowicz & Obendorf, 1992; Hu*, et al.*, 2019; Peng*, et al.*, 2017; Tong*, et al.*, 2014). AVAs present in more than 20 forms of which esters of 5-hydroxyanthranilic acid with p-coumaric (AVA-A), caffeic (AVA-B) and ferulic acids (AVA-C) were the most abundant (Collins*, et al.*, 1991). Total AVAs fluctuated significantly across the studies and varieties, with maximal variation of 29- fold (Chen*, et al.*, 2018). The highest AVAs content was observed in the bran and outer layer of oat kernels (its concentration decreased from the outer layer to endosperm) (Chen*, et al.*, 2018; Hitayezu*, et al.*, 2015). The most important factors influencing the AVAs content were the genotype and harvest time (A.R. Gulpinar*, et al.*, 2011; Tong*, et al.*, 2014).

3.2 Tocols

Tocols (Vitamin E) are lipid-soluble compounds commonly found in vegetable oils, cereal grains (barley, oats, wheat, rye, rice) and other sources. Tocols are comprised of tocopherols (TP) and tocotrienols (T3). There are four homologs for TP and T3: α, β, γ and δ, which differ in the number and position of methyl groups on the chroman ring structure (D. M. Peterson*, et al.*, 2007). The chemical structures of the tocols determine their vitamin E activity. Different isomers of tocols exhibit vitamin E activity in the following order αTP > βTP > αT3 > γTP > βT3 > δTP, with αT3 having the highest antioxidant potential(Panfili*, et al.*, 2008). In the present review, tocols content was in general higher in buckwheat than in oat (5.46-55.22mg/100g in buckwheat vs 0.50-3.61 mg/100g in oat). The highest tocopherol content was reported in whole grains and seeds. The most abundant tocols were alpha-tocotrienol and gamma-tocopherol in oat and buckwheat, respectively. A detailed report on tocols identified in oat and buckwheat can be found in Tables 1 & 2 and Supplemental Table 2.

3.3 *Phytosterols and fatty acids*

Phytosterols, plant-derived sterols, and stanols have been extensively studied due to their cholesterol-lowering effect by inhibiting the absorption of intestinal cholesterol (Leonova*, et al.*, 2008). In cereal grains, phytosterols can be found as free sterols, sterolesters, sterolglycosides and acylated sterolglycosides. Long-chain fatty acids are the major constituents of oil in grain crops and are an essential source of dietary energy.

The range of total phytosterol content was from 35mg/100g to 68.2 mg/100g in oats and 19mg/100g to 139 mg/100g in buckwheat (Table 1&2, Supplemental Table 3). The most abundant sterol in oat and buckwheat was sitosterol accounting for more than 50-70 % of total sterols, followed by campesterol. Cycloartanol was detected as a unique sterol in roasted and raw buckwheat products (Duve & White, 1991). When comparing the phytosterol composition of raw and roasted buckwheat grains, raw buckwheat grains (BG-I) had much more stigmasterol (1.3 mg/g of lipids), while the contents of campesterol, sitosterol, sitostanol, avenasterol, Δ-7-stigmasterol, and cycloartanol were significantly lower (Hamberg*, et al.*, 1998). Raw buckwheat groats contained more campesterol (3.6 mg/g of lipids), avenasterol (3.2 mg/g of lipids) and cycloartanol (1.9 mg/g of lipids) in comparison with roasted buckwheat groat (R. W. Welch, 1975).

The fatty acid content in oat and buckwheat consisted mainly of high levels of unsaturated oleic (18:1) and linoleic (18:2), and saturated palmitic (16:0) acids and lower levels of stearic (18:0) and linoleic (18:3) acids (Supplemental Table 3). Changes in the relative abundance of fatty acids were linked to the different anatomic part of the plant, genetic variants, and influence of various environmental growth factors was reported (Doehlert*, et al.*, 2013; Sinkovic*, et al.*, 2020b; R. W. Welch, 1975), *3.4 Polysaccharides*

Polysaccharides represent a structurally diverse class of biological macromolecules, with a wide range of physiological functions, including anticarcinogenic, hypolipidemic, immunoregulatory, antioxidant and neuroprotective activities (A.R. Gulpinar*, et al.*, 2011). β-glucans are heterogeneous non-starch polysaccharides, which occur in the walls of the endosperm cells (Dorrell, 1971b). β-glucans have been associated with increased intestinal viscosity and linked with improved health outcomes, such as improvements in serum blood lipids and enhanced efficiency of the immune system (Dorrell, 1971b). The β-glucan content in oat ranged from 0.03% to 8.39% in germ and endosperm. In general, β-glucan content was higher in oats (5,180- 28,200 mg/100g) than buckwheat (1,260-3,500 mg/100g) (Hozová*, et al.*, 2008). Factors such as temperature, pH, and pH-temperature interaction of the extraction process may influence β-glucan recovery and functionality (Tsuzuki*, et al.*, 1991). The amylose was the predominant polysaccharide in buckwheat, reaching 25,000 mg/100g in buckwheat starch. In addition, the levels of fagopyritols, mono-, di- and tri- galactosyl derivatives of D-chiro-inositol, were high buckwheat. Total fagopyritols content in common buckwheat ranged from 128.2 to 2774.5 mg/100g, suggesting that the common buckwheat starch may be the best source of fagopyritols.

3.5 *Saponins*

Saponins are found in various plant species, yet the oat represents the only saponin accumulating cereal. Besides being responsible for the bitter flavour of oat and playing a role in plant defense against environmental fungi attacks(Osbourn*, et al.*, 1994), saponins are suggested to promote human health by lowering cholesterol levels and affecting the immune system(Shi*, et al.*, 2004). Avenacins, stored directly in their active form, were reported in oat roots, while avenacosides (inactive forms) were reported in leaves and grains (Mary*, et al.*, 1986; Rudolf Tschesche & Lauven, 1971; Rudolf Tschesche & Wiemann, 1977). Avenacosides A (1) and B (2) are converted to their active forms: 26-desglucoavenacoside A (3) and 26-desglucoavenacoside B (4), Table 1, Supplemental Table 3. Avenacoside A represented 41.9%–60.6% and 37.1%–57.7% of total saponin content in grain and in husks respectively. Avenacoside B represented 35.8%–55.2% in grain and 13.8%–49.0% in husks of total saponin content. The content of 26-desglucoavenacoside A reached 6.4% in grain 48.3% in husks (Pecio*, et al.*, 2013). Yet, the content of avanacosides varied due to differences in cultivars, growth conditions, and sensitivity and precision of quantification methods used across different studies (Onning & Asp, 1993).

4. Strengths and Limitations of Current Review

This review was conducted following the 24-Step guideline on how to perform a systematic review, and following a predesigned review protocol (Muka*, et al.*, 2020). To exhaust relevant studies in the literature, information specialists created a highly sensitive search strategy, and additional resources were searched including the reference list of included studies. Thus, in this comprehensive systematic review of the literature, we provided the first direct comparison of phytochemical content in oat and buckwheat. However, our systematic review has some limitations worth mentioning. Although a highly sensitive search strategy was used, we were not able to search all existing online databases, and we cannot exclude the possibility of missed articles. Although we did not apply any restrictions on language and publication date, we may have missed the articles published in languages other than English. Furthermore, due to the high heterogeneity among the included studies (i.e. different anatomical part of the plant used, extraction methods or reporting units), a quantification of different results was challenging and in the results section we have focused on narrative summary of the most relevant evidence.

5. Implications for Future Research

The current evidence on phytochemical compositions of oat and buckwheat is highly heterogeneous (due to different genotypes, anatomical parts, cooking methods, extraction methods, etc.). A large number of studies included in our systematic review were published before 2010s (n=91, 59.09%). Thus, those extraction, purification and isolation methods of the active compounds in plants may not be as efficient as analyses done in the most recent studies. Future studies should take advantage of the separation technologies and the latest advances in plant genomics to investigate the genomic basis of the synthesis and function of phytochemicals, particularly based on recent advances in omics research.

Over the past three decades, the health benefits of oat have been well documented. Despite its potential to improve human health, buckwheat remains less often studied in clinical settings. Although the bioactive components responsible for the beneficial health effects of buckwheat remain insufficiently studied, its antioxidant potential and favorable lipid profile may be among the most important underlying factors. However, only a limited number of studies have examined the bioavailability of select phytochemicals (such as phenolic acids and polyphenols) from oats and buckwheat in humans and it remains insufficiently studied how these phytocompounds are metabolized in human bodies and influence human health. Thus, the findings from this review might help guide future research to further explore the health promoting aspects of oat and buckwheat in relation to the major phytochemicals and their metabolites, which in turn will shed light on health benefits these crops may deliver and their potential to be incorporated into human diet for optimal health.

6. Conclusions

Oat and buckwheat are good sources of carbohydrates, proteins, fiber, nutrients, and bioactive phytochemicals. Total phytosterols, tocols, flavonoids and rutin content were generally higher in buckwheat, β-glucans were significantly higher in oat while avenanthramides and saponins were characteristically found in oat. Despite slight differences in the content of bioactive compounds, health benefits could be attributed to bioactive compounds originating from both plants, making them both an essential constituent of human diets. For individuals with coeliac disease, these plants have the potential to be a cornerstone of "gluten-free" diets due to its trace contents found in buckwheat and oats. However, with the recent evidence on the role of food processing affecting the nutritional contents of buckwheat and oat, the industry is put into a challenge in finding a proper balance of raw food transformation. Further research is needed to identify the most active forms and the bioactivity of these compounds present in oat and buckwheat and explore the health effects of the combination of nutrients and phytochemicals.

Author's contribution

Study concept and design: Taulant Muka, Marija Glisic and Hua Kern.

Search strategy creation and online database search: Beatrice Minder.

Acquisition, collection, interpretation of data: Peter Francis Raguindin, Oche Adam Itodo, Jivko Stoyanov, Gordana M. Dejanovic, Magda Gamba, Eralda Asllanaj.

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Critical revision of the manuscript for important intellectual content: Jivko Stoyanov, Gordana M. Dejanovic, Magda Gamba, Eralda Asllanaj, Beatrice Minder, Weston Bussler, Brandon Metzger, Taulant Muka.

Study supervision: Marija Glisic and Hua Kern.

All authors approved the final version of the manuscript.

Author's disclosure

This research was supported by Standard Process. HK, WB, BMetzger are scientists at Standard Process Nutrition Innovation Center. Other authors have nothing to disclose.

Table 1. Phytochemicals and metabolites identified in oat			
No.	Compound name	Source	Author, publication year
Phytosterols			
1	$^{\Delta5}$-avenasterol	oat flour and bran; oat seed	(Maatta, *et al.*, 1999; Shewry, *et al.*, 2008)
2	$^{\Delta7}$-avenasterol	oat flour and bran; oat seed	(Maatta, *et al.*, 1999; Shewry, *et al.*, 2008)
4	24-methylene cycloartanol	roots of oat seedlings	(Trojanowska, *et al.*, 2000)
3	7-hydroxymatairesinol	oat seed	(Smeds, *et al.*, 2009)
5	campesterol	oat flour and bran	(Maatta, *et al.*, 1999; Shewry, *et al.*, 2008)
6	cycloartenol	roots of oat seedlings	(Trojanowska, *et al.*, 2000)
7	flavonolignans	oat (Poaceae) herb/plant	(Wenzig, *et al.*, 2005)
8	lariciresinol	oat seed	(Smeds, *et al.*, 2009)
9	medioresinol	oat seed	(Smeds, *et al.*, 2009)
10	metairesinol	oat seed	(Smeds, *et al.*, 2009)
11	pinoresinol	oat seed	(Smeds, *et al.*, 2009)
12	secoisolariciresinol	oat seed	(Smeds, *et al.*, 2009)
13	sitosterol	oat flour and bran; oat seed	(Maatta, *et al.*, 1999; Shewry, *et al.*, 2008) (Eichenberger Wa U, 1984)
14	stanols	oat flour and bran	(Shewry, *et al.*, 2008)
15	sterylglycosides	oat leaves	(Eichenberger Wa U, 1984)
16	stigmasterol	oat flour and bran	(Maatta, *et al.*, 1999; Shewry, *et al.*, 2008) (Eichenberger Wa U, 1984)
17	syringaresinol	oat seed	(Smeds, *et al.*, 2009)
Flavonoids			
18	4 '-*O*-(*erythro*-β-guaiacylglyceryl)	oat (Poaceae) herb/plant	(Wenzig, *et al.*, 2005)
19	4 '-*O*-(*threo*-β-guaiacylglyceryl)	oat (Poaceae) herb/plant	(Wenzig, *et al.*, 2005)
20	apigenin	oats	(Rice-Evans & Paganga, 1997)
21	kaempferol 3-O-(2",3"-di-E-p-coumaoryl-α-L-rhamnopranoside	oat bran	(WK Zhang, *et al.*, 2012)
22	kaempferol 3-O-(2" -O-E-p-coumaoryl--α-L-rhamnopranoside	oat bran	(WK Zhang, *et al.*, 2012)
23	kaempferol 3-O-(2" -O-E-p-coumaoryl--β-D-rhamnopranoside	oat bran	(WK Zhang, *et al.*, 2012)
24	kaempferol 3-O-(3" -E-p-coumaoryl--α-L-rhamnopranoside	oat bran	(WK Zhang, *et al.*, 2012)
25	kaempferol 3-O-β-D-glucopyranoside	oat bran	(WK Zhang, *et al.*, 2012)
26	linarin	oat bran	(WK Zhang, *et al.*, 2012)
27	luteolin	oats	(Collins, 1986)
28	myrcitrin	oat bran	(WK Zhang, *et al.*, 2012)
29	quercetin	husked and common oat	(Keriene, *et al.*, 2015)
30	quercitrin	oat bran	(WK Zhang, *et al.*, 2012)
31	rutin	husked oat	(Keriene, *et al.*, 2015)
32	tilianin	oat bran	(WK Zhang, *et al.*, 2012)
33	tricin	oats	(Collins, 1986)
Polysaccharides			
34	β-Glucan	starch; commercial oat bran; rolled oats	(Dawkins & Nnanna, 1995; Doehlert, *et al.*, 2013; Manthey, *et al.*, 1999; Regand, *et al.*, 2011; Shewry, *et al.*, 2008; Sowa & White, 1992 ; van den Broeck, *et al.*, 2015)

Phenolics			
33	2,2-diphenyl-1-picrylhydrazyl	hull and groat	(Varga*, et al.*, 2018)
34	4-hydrobenzoic acid	oat flour and bran	(Duve & White, 1991; Gallagher*, et al.*, 2010; Shewry*, et al.*, 2008; Soycan*, et al.*, 2019 ; Varga*, et al.*, 2018)
35	avenalumic acid and its 3'-hydroxy and 3'-methoxy derivatives	oat groats and hulls	(Collins*, et al.*, 1991)
36	Caffeic acid	oat flour; hull and groat	(Calinoiu & Vodnar, 2019 ; Dimburg*, et al.*, 1993; Emmons & Peterson, 1999; Hitayezu*, et al.*, 2015; Skoglund*, et al.*, 2008; Sosulski*, et al.*, 1982; Soycan*, et al.*, 2019; Varga*, et al.*, 2018; Xing & White, 1997)
37	coumaric acid	husked oat	(Multari*, et al.*, 2018)
38	ferulic acid	oat flour; husked oat; rolled oat; hull and groat	(Calinoiu & Vodnar, 2019; Dokuyucu*, et al.*, 2003; Emmons & Peterson, 1999; Gallagher*, et al.*, 2010; Hitayezu*, et al.*, 2015; Kovacova & Malinova, 2007; Multari*, et al.*, 2018; Skoglund*, et al.*, 2008; Sosulski*, et al.*, 1982; Soycan*, et al.*, 2019; Varga*, et al.*, 2018; V. Verardo*, et al.*, 2011; Xing & White, 1997)
39	gallic acid	hull and groat	(Brindzova*, et al.*, 2008; Chen*, et al.*, 2018; Emmons & Peterson, 1999)
40	o-coumaric acid	husked oat	(Gallagher*, et al.*, 2010; Multari*, et al.*, 2018; Xing & White, 1997)
41	p-cinnamic	oat milling fractions; husked oat	(Bratt*, et al.*, 2003; Dimberg*, et al.*, 2005; Hitayezu*, et al.*, 2015; Multari*, et al.*, 2018)
42	p-coumaric acid	oat flour and bran; rollead oat; hull and groat	(Calinoiu & Vodnar, 2019; Dokuyucu*, et al.*, 2003; Emmons & Peterson, 1999; Shewry*, et al.*, 2008; Skoglund*, et al.*, 2008; Soycan*, et al.*, 2019; Varga*, et al.*, 2018; Xing & White, 1997)
43	*p*-hydroxybenzaldehyde	hull and groat	(Emmons & Peterson, 1999 ; Soycan*, et al.*, 2019 ; Varga*, et al.*, 2018 ; V. Verardo*, et al.*, 2011)
44	p-hydroxybenzoic acid	oat flour	(Calinoiu & Vodnar, 2019; Sosulski*, et al.*, 1982 ; Xing & White, 1997)
45	phytic acid	oat products	(Larsson & Sandberg, 1992)
46	sinapic acid	oat flour	(Calinoiu & Vodnar, 2019 ; Shewry*, et al.*, 2008 ; Soycan*, et al.*, 2019; Xing & White, 1997)
47	syringaldehyde	husked oat	(Gallagher*, et al.*, 2010; Multari*, et al.*, 2018)
48	syringic	oat flour; husked oat	(Shewry*, et al.*, 2008; Sosulski*, et al.*, 1982; Soycan*, et al.*, 2019; Varga*, et al.*, 2018 ; V. Verardo*, et al.*, 2011)
49	*trans*-cinnamic acid	hull and groat	(Emmons & Peterson, 1999)
50	trans-ferulic	oat flour	(Sosulski*, et al.*, 1982);
51	vanillic acid	oat flour; husked oat	(Calinoiu & Vodnar, 2019; Emmons & Peterson, 1999 ; Gallagher*, et al.*, 2010 ; Garleb*, et al.*, 1991; Hitayezu*, et al.*, 2015; Multari*, et al.*, 2018 ; Shewry*, et al.*, 2008; Sosulski*, et al.*, 1982; Soycan*, et al.*, 2019; Varga*, et al.*, 2018; V. Verardo*, et al.*, 2011; Xing & White, 1997)
Alkaloids			
52	AVA-2fd	seeds	(de Bruijn*, et al.*, 2019)

53	AVA-2pd	seeds	(de Bruijn, *et al.*, 2019)
54	AVA-5fd	seeds	(de Bruijn, *et al.*, 2019)
55	AVA-5pd	seeds	(de Bruijn, *et al.*, 2019)
56	AVA-2C	oat milling fractions; husked oat	(Bratt, *et al.*, 2003; Calinoiu & Vodnar, 2019; Chen, *et al.*, 2018; de Bruijn, *et al.*, 2019; Dimberg, *et al.*, 2005 ; Dokuyucu, *et al.*, 2003; Gunther-Jordanland, *et al.*, 2016; Hitayezu, *et al.*, 2015; Hu, *et al.*, 2019; Mattila, *et al.*, 2005; Multari, *et al.*, 2018; Ortiz-Robledo, *et al.*, 2013; D. M. Peterson & Dimberg, 2008; Pridal, *et al.*, 2018; Shewry, *et al.*, 2008; Skoglund, *et al.*, 2008; Varga, *et al.*, 2018; V. Verardo, *et al.*, 2011; Xie, *et al.*, 2017)
57	AVA-2F	oat milling fractions; husked oat	(Bratt, *et al.*, 2003; Calinoiu & Vodnar, 2019; Chen, *et al.*, 2018; Dimberg, *et al.*, 2005 ; Dokuyucu, *et al.*, 2003; Gunther-Jordanland, *et al.*, 2016; Hitayezu, *et al.*, 2015; Hu, *et al.*, 2019; Mattila, *et al.*, 2005; Multari, *et al.*, 2018; Ortiz-Robledo, *et al.*, 2013; D. M. Peterson & Dimberg, 2008; Pridal, *et al.*, 2018 ; Shewry, *et al.*, 2008; Skoglund, *et al.*, 2008; Varga, *et al.*, 2018; Xie, *et al.*, 2017);
58	AVA-2P	oat milling fractions; husked oat	(Bratt, *et al.*, 2003; Calinoiu & Vodnar, 2019; Chen, *et al.*, 2018; Dimberg, *et al.*, 2005 ; Dokuyucu, *et al.*, 2003; Gunther-Jordanland, *et al.*, 2016; Hitayezu, *et al.*, 2015; Hu, *et al.*, 2019 ; Mattila, *et al.*, 2005; Multari, *et al.*, 2018; Ortiz-Robledo, *et al.*, 2013; D. M. Peterson & Dimberg, 2008; Pridal, *et al.*, 2018 ; Shewry, *et al.*, 2008; Skoglund, *et al.*, 2008; Varga, *et al.*, 2018; Xie, *et al.*, 2017)
59	AVA A-1	oat flour and bran groat and hull	(Bratt, *et al.*, 2003; Chen, *et al.*, 2018 ; Collins, 1989 ; Gunther-Jordanland, *et al.*, 2016 ; Hu, *et al.*, 2019) (Collins, 1989; Dimburg, *et al.*, 1993)
60	AVA B	groat and hull	(Collins, 1989)
61	AVA B-1	groat and hull	(Collins, 1989)
62	AVA C	groat and hull	(Collins, 1989 ; Soycan, *et al.*, 2019)
63	AVA C-1	groat and hull	(Collins, 1989)
64	AVA D	groat and hull	(Collins, 1989)
65	AVA D-1	groat and hull	(Collins, 1989)
66	AVA E	groat and hull	(Collins, 1989)
67	AVA E-1	groat and hull	(Collins, 1989)

68	AVA-1F	oat flour	(Bratt*, et al.*, 2003; Chen*, et al.*, 2018; Collins, 1989; Gunther-Jordanland*, et al.*, 2016)
69	AVA-1P	oat flour	(Bratt*, et al.*, 2003; Chen*, et al.*, 2018 ; Collins, 1989; Gunther-Jordanland*, et al.*, 2016)
70	AVA-1S	oat flour	(Bratt*, et al.*, 2003; Chen*, et al.*, 2018 ; Collins, 1989; Gunther-Jordanland*, et al.*, 2016)
71	AVA-2S	oat flour	(Gunther-Jordanland*, et al.*, 2016)
72	AVA-3F	grains	(Skoglund*, et al.*, 2008)
73	AVA-6f	seeds	(de Bruijn*, et al.*, 2019)
n.a.	avenanthramides total	oat groats, hulls and seeds; husked oat	(Bratt*, et al.*, 2003; Chen*, et al.*, 2018; Collins*, et al.*, 1991; Emmons & Peterson, 1999; Hu*, et al.*, 2019; Ishihara*, et al.*, 2014; Multari*, et al.*, 2018 ; Pridal*, et al.*, 2018; Shewry*, et al.*, 2008; Xie*, et al.*, 2017)
74	gramine	Avena sativa	(Duke, 1992)
Tocols			
75	α-T	various oats	(Musa Ozcan*, et al.*, 2006; D.M. Peterson & Qureshi, 1993; Shewry*, et al.*, 2008; van den Broeck*, et al.*, 2015; York*, et al.*, 1993)
76	A-T3	various oats	(Shewry*, et al.*, 2008; van den Broeck*, et al.*, 2015; York*, et al.*, 1993)
77	B-T	various oats	(Musa Ozcan*, et al.*, 2006; Shewry*, et al.*, 2008; York*, et al.*, 1993)
78	B-T3	various oats	(Shewry*, et al.*, 2008; York*, et al.*, 1993)
79	g-T	various oats	(Musa Ozcan*, et al.*, 2006; York*, et al.*, 1993)
80	6-T3	various oats	(York*, et al.*, 1993)
Folates			
81	Total folates	oat flour and bran	(Shewry*, et al.*, 2008)
Proteins/enzymes			
82	fraction I protein	0at leaves	(Steer*, et al.*, 1968)
83	globulin	various oats	(Klose*, et al.*, 2009; Runyon*, et al.*, 2013)
84	glutelin	oat seeds/groat	(Klose*, et al.*, 2009; Runyon*, et al.*, 2013)
85	oat protein isolate	Chinese oat	(G Liu*, et al.*, 2009)
86	prolamin	oat seeds/groat	(Klose*, et al.*, 2009)
Lipids/Fatty Acids			
87	1,2-diacylglycerol	wild and cultivated oat	(Leonova*, et al.*, 2008)
88	1,3-diacylglycerol	wild and cultivated oat	(Leonova*, et al.*, 2008)
89	7-hydroxyhexadecanoic	wild and cultivated oat	(Leonova*, et al.*, 2008)
90	cylphosphatidylglycerols	oat extract	(Holmback*, et al.*, 2001)
91	1-[(9′*Z*),(12′*Z*)-octadecadienoyl]-2-[(15″*R*)-(C Chen*, et al.*, 2020)-(9″*Z*),(12″*Z*)-octadecadienoyl]-3-(α-D-galactopyranosyl-1-6-β-D-galactopyranosyl)-glycerol.	oat seeds	(Hamberg*, et al.*, 1998)
92	galactolipid estolides	oat kernels	(Moreau*, et al.*, 2008)
93	N-acylphosphatidylethanolamines	oat extract	(Holmback*, et al.*, 2001)
94	sterylglycosides	oat leaves	(Eichenberger Wa U, 1984)

95	TAG1	wild and cultivated oat	(Leonova, *et al.*, 2008)
96	TAG2	wild and cultivated oat	(Leonova, *et al.*, 2008)
97	C:16	Oat various cultivars	(Banas, *et al.*, 2007; Brindzova, *et al.*, 2008; Dimberg, *et al.*, 2005; Duve & White, 1991; van den Broeck, *et al.*, 2015; R.W. Welch, 1975)
98	C18:0	oat various cultivars	(Banas, *et al.*, 2007; Brindzova, *et al.*, 2008; Dimberg, *et al.*, 2005 ; Duve & White, 1991; van den Broeck, *et al.*, 2015; R.W. Welch, 1975)
99	C18:1	oat various cultivars	(Banas, *et al.*, 2007; Brindzova, *et al.*, 2008; Dimberg, *et al.*, 2005; Duve & White, 1991; van den Broeck, *et al.*, 2015; R.W. Welch, 1975)
100	C18:2	oat various cultivars	(Banas, *et al.*, 2007; Brindzova, *et al.*, 2008; Dimberg, *et al.*, 2005; Duve & White, 1991; van den Broeck, *et al.*, 2015; R.W. Welch, 1975)
101	Avenoleic acid	oat seeds;	(Hamberg, *et al.*, 1998)
102	15-hydroxy 18:2$^{\Delta 9,12}$ (avenoleic acid)	wild and cultivated oat	(Leonova, *et al.*, 2008)
Saponins			
103	3-(O-α-L-rhamnopyranosyl(1→2)-[β-D-glucopyranosyl(1→4)]-β-D-glucopyranosid)-26-O-β-D-glucopyranosyl-(25R)-furost-5-ene-3β,22,26-triol	oat flour	(Gunther-Jordanland, *et al.*, 2016)
104	3-(O-α-L-rhamnopyranosyl(1→2)-[β-D-glucopyranosyl(1→3)-β-D-glucopyranosyl(1→4)]-β-D-glucopyranosid)-26-O-β-D-glucopyranosyl-(25R)-furost-5-ene-3β,22,26-triol	oat flour	(Gunther-Jordanland, *et al.*, 2016)
105	avenacoside A (nuatigenin-3-O-(α-L-rhamnopyranosyl-(1→2)-[β-Dglucopyranosyl-(1→4)]-β-D-glucopyranoside)-26-O-β-D-glucopyranoside)	oat flour, grain	(Bahraminejad, *et al.*, 2008; Gunther-Jordanland, *et al.*, 2016; Onning & Asp, 1993; Pecio, *et al.*, 2013; Rudolf Tschesche, *et al.*, 1969; Rudolf Tschesche & Wiemann, 1977)
106	avenacoside B (nuatigenin-3-O-(α-L-rhamnopyranosyl-(1→2)-[β-D-glucopyranosyl-(1→3)-β-D-glucopyranosyl-(1→4)]-β-D-glucopyranoside)-26-O-β-D-glucopyranoside)	oat flour, grains	(Bahraminejad, *et al.*, 2008; Gunther-Jordanland, *et al.*, 2016; Onning & Asp, 1993; Pecio, *et al.*, 2013; Rudolf Tschesche & Lauven, 1971; Rudolf Tschesche & Wiemann, 1977; R. Tschesche & Wulff, 1973)
107	Avenacin A-1*		(Mary, *et al.*, 1986)
108	Avenacin A-2		(Mary, *et al.*, 1986)
109	Avenacin B-1		(Mary, *et al.*, 1986)
110	Avenacin B-2		(Mary, *et al.*, 1986)
111	26-desglucoavenacoside A	grain	(Bahraminejad, *et al.*, 2008; Pecio, *et al.*, 2013)
112	26-desglucoavenacoside B	Shoots	(Bahraminejad, *et al.*, 2008)
113	avenacins (b-Amyrin, squalene)	roots of oat seedlings	(Trojanowska, *et al.*, 2000)
* A-1, A-2, B-1 and B-2: these are trisaccharide-bearing triterpenes esterified (A-1, B-1) with N-methylanthranilic acid or (A-2, B-2) benzoic acid.			

Table 2 Phytochemicals reported in buckwheat			
No.	**Compound name**	**Source**	**Author, publication year**
Tannins			
1	procyanidin B-1	Fd	(KJ Wang, *et al.*, 2005)
2	procyanidin B-2	Fd	(KJ Wang, *et al.*, 2005)
3	3,3-di-O-galloyl-procyanidinB-2	Fd	(KJ Wang, *et al.*, 2005)
4	3-O-galloyl-procyanidinB-2	Fd	(KJ Wang, *et al.*, 2005)
Cyclitol			
5	fagopyritol A1	Fe	(Ralph L. Obendorf, *et al.*, 2000)
6	fagopyritol A2	Fe	(Steadmana, *et al.*, 2001)
7	fagopyritol A3	Fe	(Steadmana, *et al.*, 2001)
8	fagopyritol B1	Fe	(Ralph L. Obendorf, *et al.*, 2000)
9	fagopyritol B2	Fe	(R. L. Obendorf, 1997)
10	fagopyritol B3	Fe	(R. L. Obendorf, 1997)
Triterpenoids			
11	ursolic acid	Ft	(JM Lee, *et al.*, 2013)
12	olean-12-en-3-ol	Fe	(F Zheng, *et al.*, 2004)
13	urs-12-en-3-ol	Fe	(F Zheng, *et al.*, 2004)
14	glutinone	Fd	(Shao, *et al.*, 2005)
15	glutinol	Fd	(Shao, *et al.*, 2005)
Steroids			
16	β-sitosterol	Fd	(Bao, *et al.*, 2003)
17	daucosterol	Fd	(Bao, *et al.*, 2003)
18	peroxidize-ergosterol	Fd	(Bao, *et al.*, 2003)
19	stigmsat-4-en -3,6-dione	Fd	(Bao, *et al.*, 2003)
20	β -sitosterol-palmitate	Fd	(Bao, *et al.*, 2003)
21	6-hydroxystigmasta-4,22-dien-3-one	Fe	(F Zheng, *et al.*, 2004)
22	23S-methylcholesterol	Fe	(F Zheng, *et al.*, 2004)
23	trans-stigmast-5,22-dien-3-ol	Fe	(F Zheng, *et al.*, 2004)
24	stigmast-5,24-dien-3-ol	Fe	(F Zheng, *et al.*, 2004)
25	stigmast-5-en-3-ol	Fe	(F Zheng, *et al.*, 2004)
Fatty acids			
26	C24:0	Fe	(Krumina-Zemture & Beitane, 2018; Tien, *et al.*, 2018; Tsuzuki, *et al.*, 1991)
27	C24:1	Fe	(Krumina-Zemture & Beitane, 2018)
28	C12:0	Ft	(Tien, *et al.*, 2018)
29	C14:0	Ft, Fe	(Golijan, *et al.*, 2019; Krumina-Zemture & Beitane, 2018; Tien, *et al.*, 2018)
30	C15:0	Ft	(Krumina-Zemture & Beitane, 2018; Tien, *et al.*, 2018)
31	C16:0	Fe, Ft	(Dziadek, *et al.*, 2016; Golijan, *et al.*, 2019; A.R. Gulpinar, *et al.*, 2011; Khalass, *et al.*, 2018; Krumina-Zemture & Beitane, 2018; Sinkovic, *et al.*, 2020a; Tien, *et al.*, 2018 ; Tsuzuki, *et al.*, 1991)
32	C16:1	Ft	(Golijan, *et al.*, 2019; Tien, *et al.*, 2018)
33	C17:1	Ft	(Tien, *et al.*, 2018)
34	C18:0	Fe, Ft	(Dziadek, *et al.*, 2016; Golijan, *et al.*, 2019 ; A.R. Gulpinar, *et al.*, 2011; Khalass, *et al.*, 2018; Krumina-Zemture & Beitane, 2018 ; Sinkovic, *et al.*, 2020a; Tien, *et al.*, 2018; Tsuzuki, *et al.*, 1991)
35	C18:1	Fe, Ft	(Dorrell, 1971a; Dziadek, *et al.*, 2016; Golijan, *et al.*, 2019; A.R. Gulpinar, *et al.*, 2011 ; Khalass, *et al.*, 2018; Krumina-Zemture & Beitane, 2018; Sinkovic, *et al.*, 2020a; Tien, *et al.*, 2018; Tsuzuki, *et al.*, 1991)
36	C18:2	Fe, Ft	(Dziadek, *et al.*, 2016; Golijan, *et al.*, 2019; A.R. Gulpinar, *et al.*, 2011; Khalass, *et al.*, 2018; Sinkovic, *et al.*, 2020a; Tien, *et al.*, 2018; Tsuzuki, *et al.*, 1991)
37	C18:3	Fe, Ft	(Golijan, *et al.*, 2019; A.R. Gulpinar, *et al.*, 2011; Krumina-Zemture & Beitane, 2018 ; Sinkovic, *et al.*, 2020a; Tien, *et al.*, 2018; Tsuzuki, *et al.*, 1991);

38	C20:0	Fe, Ft	(Golijan, *et al.*, 2019; A.R. Gulpinar, *et al.*, 2011; Sinkovic, *et al.*, 2020a ; Tsuzuki, *et al.*, 1991);
39	C20:1	Fe, Ft	(Golijan, *et al.*, 2019; A.R. Gulpinar, *et al.*, 2011; Krumina-Zemture & Beitane, 2018; Tien, *et al.*, 2018; Tsuzuki, *et al.*, 1991)
40	C20:5	Fe	(Krumina-Zemture & Beitane, 2018)
41	C22:0	Fe, Ft	(Tien, *et al.*, 2018)
42	C22:1	Fe	(A.R. Gulpinar, *et al.*, 2011; Tien, *et al.*, 2018; Tsuzuki, *et al.*, 1991)
43	C23:0	Fe	(Krumina-Zemture & Beitane, 2018)
44	4,7-dihydroxy-3,7-dimethyl-octa-2(E),5(E)-dienoic acid	Fe	(Cho, *et al.*, 2006)
45	6,7-dihydroxy-3,7-dimethyl-octa-2(Z),4(E)-dienoic acid	Fe	(Cho, *et al.*, 2006)
46	6,7-dihydroxy-3,7-dimethyl-octa-2(E),4(E)-dienoic acid	Fe	(Cho, *et al.*, 2006)
Polysaccharides			
40	amylopectin	Fe	(Qin, *et al.*, 2010; Takahama & Hirota, 2010)
47	amylose	Fe	(Qin, *et al.*, 2010; Takahama & Hirota, 2010)
41	BBF1-3	Fl	(Lin & Lin, 2016)
48	BWPSs	Fe	(Zemnukhova, *et al.*, 2007; Zemnukhova, *et al.*, 2004)
49	CBF1-3	Fe	(Lin & Lin, 2016)
39	galactinol	Fe	(Steadman, *et al.*, 2000)
50	inositol	Fe	(Steadman, *et al.*, 2001)
51	myo-inositol	Fe	(Steadman, *et al.*, 2000)
52	SDF (carboxymethylated)	Fe	(KY Lee, *et al.*, 2014)
53	SDF (methanolysis)	Fe	(Wefers & Bunzel, 2015)
54	sucrose	Fe	(Steadman, *et al.*, 2000)
55	TBP-1-3	Fe	(Yan, *et al.*, 2011)
56	TBP-II	Ft	(XT Wang, *et al.*, 2016)
57	α-galactosides	Fe	(Steadman, *et al.*, 2000)
	Beta-glucan	Fe	(Hozová, *et al.*, 2008)
Phenols			
58	1,3,6-tri-feruloyl-6-p-coumaroyl sucrose	Ft	(Ren, *et al.*, 2013)
59	1,3,6-tri-p-coumaroyl-61-feruloyl sucrose	Ft	(Ren, *et al.*, 2013)
60	1,3-dimethoxy-2-O-b-xylo-pyranosyl-5-O-glucopyranosyl-benzene	Fd	(Bai, *et al.*, 2007)
61	3,4-dihydroxybenzaldehyde	Fd, Fe	(Shao, *et al.*, 2005); (Watanabe, *et al.*, 1997)
62	3,6-di-p-coumaroyl-1,61-di-feruloyl sucrose	Ft	(Ren, *et al.*, 2013)
63	benzoic acid	**Fd**	(Park, *et al.*, 2019; Wu, *et al.*, 2008)
64	caffeic acid	**Ft, Fe**	(Alvarez-Jubete, *et al.*, 2010; Park, *et al.*, 2019; Terpinc, *et al.*, 2016; Wefers & Bunzel, 2015; Xu, *et al.*, 2002)
65	chlorogenic acid	Fe, Ft	(SJ Kim, *et al.*, 2008; Kraujaliene, *et al.*, 2017; Y Liu, *et al.*, 2019; Pankaja, 2011; Park, *et*

			al., 2019; Sadauskiene*, et al.*, 2018; Sytar, 2015)
66	Neochloreogenic	Fe	(Sadauskiene*, et al.*, 2018)
67	Fagopyrin	Fe	(Habtemariam, 2019; Sadauskiene*, et al.*, 2018)
68	Tannic acid	Fe	(Sadauskiene*, et al.*, 2018)
69	Hyperoside	Fe	(Quettier-Deleu*, et al.*, 2000; Sadauskiene*, et al.*, 2018)
70	ferulic acid (tras- and cis- isomers)	**Ft**	(Hung & Morita, 2008; Y Liu*, et al.*, 2019; Sedej*, et al.*, 2012; Wefers & Bunzel, 2015; Xu*, et al.*, 2002)
71	gallic acid	Fd, Fe	(F Li*, et al.*, 2013; Y Liu*, et al.*, 2019; Park*, et al.*, 2019; Sytar, 2015; Terpinc*, et al.*, 2016; KJ Wang*, et al.*, 2005)
72	p-coumaric acid	Ft	(Sytar, 2015; Wefers & Bunzel, 2015; Xu*, et al.*, 2002)
73	p-hydroxybenzoic acid	Fd	(Y Liu*, et al.*, 2019; Tian & Xu, 1997)
74	Protocatechuic acid	**Ft**	(Y Liu*, et al.*, 2019; Sedej*, et al.*, 2012; Watanabe*, et al.*, 1997)
75	protocatechuic acid methyl ester	Fd	(Shao*, et al.*, 2005)
76	resveratrol	Fe	(Watanabe*, et al.*, 1997)
77	Sinapic acid	**Ft**	(Y Liu*, et al.*, 2019; Sedej*, et al.*, 2012; Wefers & Bunzel, 2015)
78	syringic acid	**Ft**	(XD Guo*, et al.*, 2011; Y Liu*, et al.*, 2019; Xu*, et al.*, 2002)
79	taroside (1,3,6,61-tetra-feruloyl sucrose)	Ft	(Ren*, et al.*, 2013)
80	tatariside A-G	**Ft**	(C Zheng*, et al.*, 2012)
81	vanillic acid	**Ft**	(Sedej*, et al.*, 2012; Xu*, et al.*, 2002)
82	Caffeic acid hexose	Fe	(Vito Verardo*, et al.*, 2010)
83	2-Hydroxy-3-O-b-Dglucopyranosil-benzoic acid	Fe	(Vito Verardo*, et al.*, 2010)
84	Methoxy-cinnamic acid	Fe, Ft	(Sytar, 2015)
85	Salicylic acid	Fe, Ft	(Sytar, 2015)
86	p-Anisic acid	Fe, Ft	(Sytar, 2015)
Flavonoids			
87	(-)-epicatechin	Fe, Fd	(Kalinova*, et al.*, 2006; Park*, et al.*, 2019; Quettier-Deleu*, et al.*, 2000; Watanabe*, et al.*, 1997)
88	(-)-epicatechin-3-O-(3,4-di-O-methyl)-gallate	Fe	(Vito Verardo*, et al.*, 2010; Watanabe*, et al.*, 1997)
89	(-)-epicatechin-3-O-p-hydroxybenzoate	Fe	(Watanabe*, et al.*, 1997)
90	(+)-catechin	Fd	(Park*, et al.*, 2019; KJ Wang*, et al.*, 2005)
91	(+)-catechin-7-O-glucoside		(Watanabe*, et al.*, 1997)
92	(3-methoxyphenyl)-2-piperidinemethanol	Fd	(Shao*, et al.*, 2005)
93	(Epi)afzelchine(epi)catechin isomer A	Fe	(Vito Verardo*, et al.*, 2010)
94	(Epi)afzelchine(Epi)catechin isomer B	Fe	(Vito Verardo*, et al.*, 2010)
95	(Epi)afzelchine(epi)catechin isomer C	Fe	(Vito Verardo*, et al.*, 2010)
96	(Epi)afzelchine(epi)catechin isomer D	Fe	(Vito Verardo*, et al.*, 2010)
97	1-O-Caffeoyl-6-O-alpharhamnopyranosyl-betaglycopyranoside (swertiamacroside)	Fe	(Vito Verardo*, et al.*, 2010)
98	3, 4-dihydroxy benzamine	Fd	(Shao*, et al.*, 2005)
99	3,5-dimethylquercetin	Fd	(KJ Wang*, et al.*, 2005)
100	3',4'-methylenedioxy-7-hydroxy-6-isopentenyl flavone	Fd	(Saxena, 1987)
101	3-methylgossypetin-8-O-_-D-glucopyranoside	Fd	(KJ Wang*, et al.*, 2005)
102	3-methylquercetin	Fd	(KJ Wang*, et al.*, 2005)
103	5, 5'-di-α-furaldehyde dimethyl ester	Ft	(Tian & Xu, 1997)
104	5,7,31,41-tetramethylquercetine-3-O-rutinoside	Ft	(Saxena, 1987)
105	7-hydroxycoumarin	Ft	Sun, B.H et al, 2008

106	Apigenin	Fe	(Terpinc, *et al.*, 2016)
107	aromadendrin-3-O-D-galactoside		(Watanabe, *et al.*, 1997)
108	Catechin-glucoside	Fe	(Vito Verardo, *et al.*, 2010)
109	emodin	Fd	(Bao, *et al.*, 2003)
110	emodin-8-O-β D--glucopyranoside	Fd	Wang, K. et al, 2005
111	Epiafzelchine epicatechin-O-methyl gallate	Fe	(Vito Verardo, *et al.*, 2010)
112	Epiafzelchine-epicatechin-O-di methyl gallate	Fe	(Vito Verardo, *et al.*, 2010)
113	Epicatechin-gallate	Fe	(Quettier-Deleu, *et al.*, 2000; Vito Verardo, *et al.*, 2010)
114	fagopyrin	Fe, Ft	(Habtemariam, 2019; Kreft, *et al.*, 2013)
115	fructose	Ft	(KJ Wang, *et al.*, 2005)
116	hesperidin	Fd	(Wu, *et al.*, 2008)
117	hyperin/isoquercitrin (quercetin-3-O-glucoside)	Fe	(Ren, *et al.*, 2013; Watanabe, *et al.*, 1997)
118	isoorientin	Fe, Ft	(T Chen, *et al.*, 2020; HJ Kim, *et al.*, 2011; SJ Kim, *et al.*, 2008; Kraujaliene, *et al.*, 2017; Nam, *et al.*, 2015; Pankaja, 2011)
119	isovitexin	Fe, Ft	(T Chen, *et al.*, 2020; Dietrych-Szostak & Oleszek, 1999; SJ Kim, *et al.*, 2008; Nam, *et al.*, 2015; Pankaja, 2011)
120	kaempferol	Fd, Ft	(Jiang, *et al.*, 2015; JM Lee, *et al.*, 2013; Terpinc, *et al.*, 2016)
121	kaempferol-3-O-galactoside	Ft	(Bao, *et al.*, 2003; Jiang, *et al.*, 2015; KJ Wang, *et al.*, 2005)
122	kaempferol-3-O-glucoside	Ft	(Bao, *et al.*, 2003; Jiang, *et al.*, 2015; KJ Wang, *et al.*, 2005)
123	kaempferol-3-O-glucoside-7-O-glucoside	Fe	(Watanabe, *et al.*, 1997)
124	kaempferol-3-O-rutinoside	Ft	(Bao, *et al.*, 2003; Jiang, *et al.*, 2015; KJ Wang, *et al.*, 2005)
125	kaempferol-3-O-sophoroside	Fe	(Watanabe, *et al.*, 1997)
126	luteolin	Fd	(Shao, *et al.*, 2005; Terpinc, *et al.*, 2016)
127	Luteolin-glycosid	Fe	(Vito Verardo, *et al.*, 2010)
128	myricetin	Fe, Fd	(Kalinova, *et al.*, 2006)
129	naringenin	Fe	(Pankaja, 2011; Terpinc, *et al.*, 2016)
130	n-butyl-β-D-fructopyranoside	Fd	(Shao, *et al.*, 2005)
131	N-trans-feruloyltyramine	Ft	(Ren, *et al.*, 2013)
132	orientin	Fe, Ft	(T Chen, *et al.*, 2020; HJ Kim, *et al.*, 2011; SJ Kim, *et al.*, 2008; Nam, *et al.*, 2015)
133	Procyanidin B2	Fe	(Vito Verardo, *et al.*, 2010); (Quettier-Deleu, *et al.*, 2000)
134	Procyanidin B2 dimethyl gallate	Fe	(Vito Verardo, *et al.*, 2010)
135	Procyanidin B2-3-O-gallate	Fe	(Vito Verardo, *et al.*, 2010)
136	Quercetin	Ft	(T Chen, *et al.*, 2020 ; Ge & Wang, 2020; Kočevar Glavač, *et al.*, 2017; JM Lee, *et al.*, 2013; Sadauskiene, *et al.*, 2018; Sedej, *et al.*, 2012; Terpinc, *et al.*, 2016; Vito Verardo, *et al.*, 2010)
137	quercetin-3-O-(211-O-p-hydroxy-coumaroyl)-glucoside	Fd	(KJ Wang, *et al.*, 2005);
138	quercetin-3-O-[_-D-xyloxyl-(1Ñ2)-_-L-rhamnoside]	Ft	(Ren, *et al.*, 2013)
139	quercetin-3-O-_-D-galactoside	Ft, Fe	(Nam, *et al.*, 2015; Ren, *et al.*, 2013; Watanabe, *et al.*, 1997)
140	quercetin-3-O-rutinoside-31-O-_-glucopyranoside	Fd, Ft	(Wu, *et al.*, 2008)
141	quercetin-3-O-rutinoside-7-O-galactoside	Ft	(Saxena, 1987)
142	quercitrin (quercetin-3-O-rhamnoside)	Fd, Ft	(Ren, *et al.*, 2013; KJ Wang, *et al.*, 2005)
143	rhamnetin	Fd	(Wu, *et al.*, 2008)
144	rutin	Fd, Fe, Ft	(T Chen, *et al.*, 2020 ; Dietrych-Szostak & Oleszek, 1999; Fabjan, *et al.*, 2003; Ge & Wang, 2020 ; XD Guo, *et al.*, 2011; Habtemariam, 2019; Holasovaa, *et al.*, 2002; Hung & Morita, 2008; Kalinova, *et al.*, 2006; Keriene, *et al.*, 2015 ; HJ Kim, *et al.*, 2011; Kočevar Glavač, *et al.*, 2017; Kraujaliene, *et al.*, 2017; Kreft, *et al.*, 1999; Nam, *et al.*, 2015; B. Dave Oomah & Giuseppe Mazza, 1996; Park, *et al.*, 2019; Quettier-Deleu, *et al.*, 2000; Sadauskiene, *et al.*, 2018; Sedej, *et al.*, 2012; KJ Wang, *et al.*, 2005)

145	squalene	Fe	(F Zheng*, et al.*, 2004)
146	succinic acid	Fd	(Tian & Xu, 1997)
147	sucrose	Ft	(KJ Wang*, et al.*, 2005)
148	taxifolin-3-O-D-xyloside	Fe	(Watanabe*, et al.*, 1997)
149	uracil	Ft	(Bao*, et al.*, 2003)
150	vitexin	Fe, Ft	(T Chen*, et al.*, 2020; HJ Kim*, et al.*, 2011; SJ Kim*, et al.*, 2008; Nam*, et al.*, 2015; Pankaja, 2011)
Vitamins			
151	A (β-carotene)	Fe, Ft,Fd	(Gabrovská*, et al.*, 2002)
152	B1 (thiamine)	Fe, Ft,Fd	(Bonafaccia*, et al.*, 2003)
153	B2 (riboflavin)	Fe, Ft,Fd	(Bonafaccia*, et al.*, 2003)
154	B5 (pantothenic acid)	Fe, Ft,Fd	(Gabrovská*, et al.*, 2002)
155	B6 (pyridoxine)	Fe, Ft,Fd	(Bonafaccia*, et al.*, 2003)
156	C (ascorbic acid)	Fe, Ft,Fd	(Lintschinger*, et al.*, 1997)
157	E (tocopherols)	Fe, Ft,Fd	(SL Kim, Kim, S. K., and Park, C. H., 2002)
158	Alpha-tocopherol	Fe	(Sedej*, et al.*, 2012)
159	Beta--tocopherol	Fe	(Sedej*, et al.*, 2012)
160	Gamma-tocopherol	Fe	(Sedej*, et al.*, 2012; F Zheng*, et al.*, 2004)
Minerals			
161	Boron	Fe	(Ikeda*, et al.*, 2006; Steadman*, et al.*, 2001)
162	Calcium	Fe, Ft,Fd	(Ikeda*, et al.*, 2005; Q Zhang & Xu, 2017)
163	Copper	Fe, Ft,Fd	(Ikeda*, et al.*, 2005; Q Zhang & Xu, 2017)
164	Iron	Fe, Ft,Fd	(Ikeda*, et al.*, 2002; Q Zhang & Xu, 2017)
165	Magnesium	Fe, Ft,Fd	(Ikeda*, et al.*, 2005)
166	Manganese	Fe, Ft,Fd	(Ikeda*, et al.*, 2005; Q Zhang & Xu, 2017)
167	Phosphorus	Fe, Ft,Fd	(Ikeda*, et al.*, 2005; Q Zhang & Xu, 2017)
168	Potassium	Fe, Ft,Fd	(Ikeda*, et al.*, 2005)
169	Zinc	Fe, Ft,Fd	(Ikeda*, et al.*, 2005; Q Zhang & Xu, 2017)
Protein			
170	Albumin	Ft	(X Guo*, et al.*, 2007; Siwatch*, et al.*, 2019)
171	Globulin	Ft	(X Guo*, et al.*, 2007)
172	Prolamin	Ft	(X Guo*, et al.*, 2007)
173	Glutelin	Ft	(X Guo*, et al.*, 2007)
174	TBPC or TBP	Ft	(C Zhang*, et al.*, 2005; Z Zhang*, et al.*, 1999)
175	TBWSP31	Ft	(X Guo*, et al.*, 2007)
176	TBTI	Ft	(Z Wang*, et al.*, 2004)
177	DTPF	Ft	(CH Li*, et al.*, 2002)
178	TBa, TBb, TBt	Ft	(Z Wang*, et al.*, 2006)

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Figure 1. Flowchart of studies included in current review

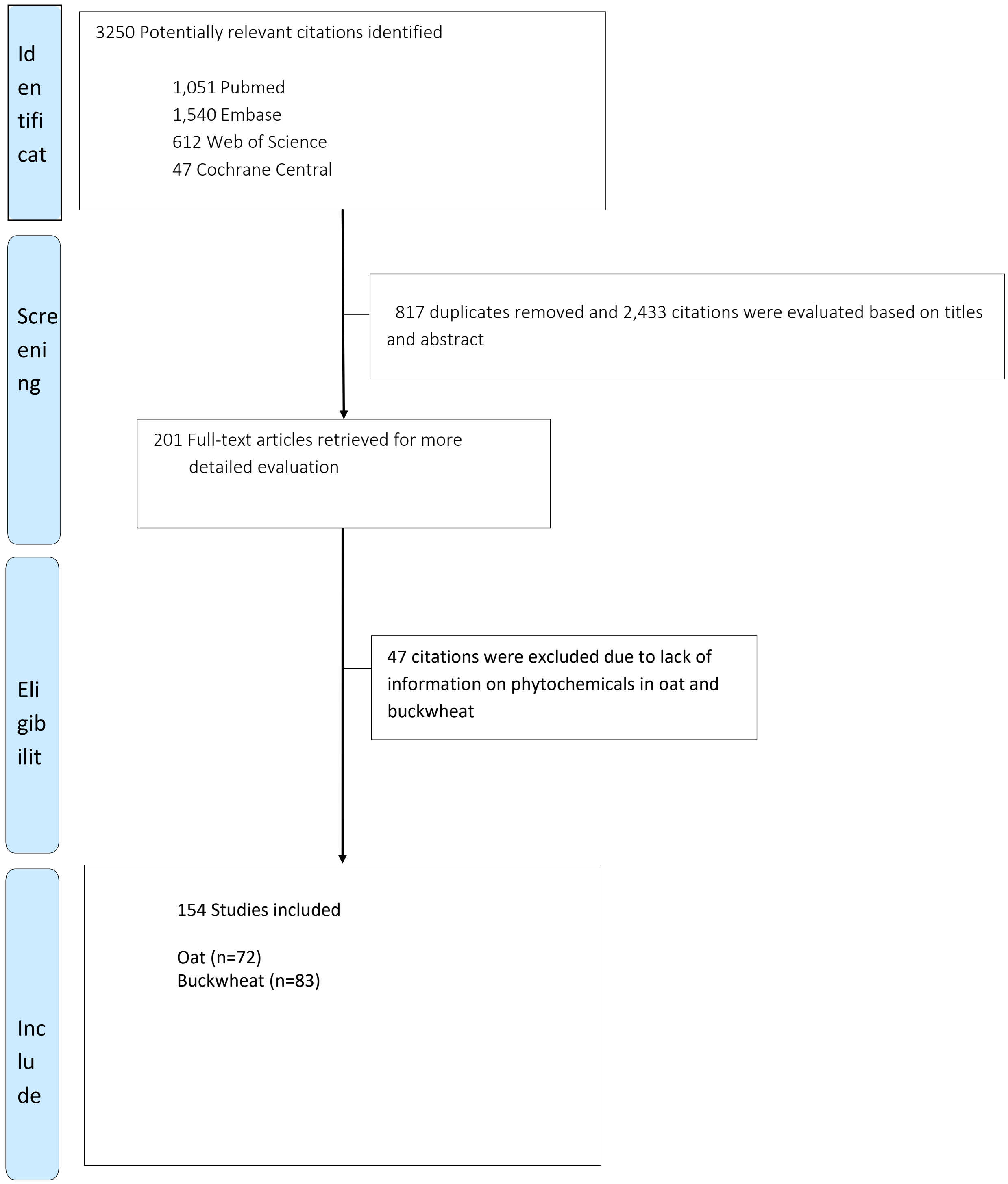
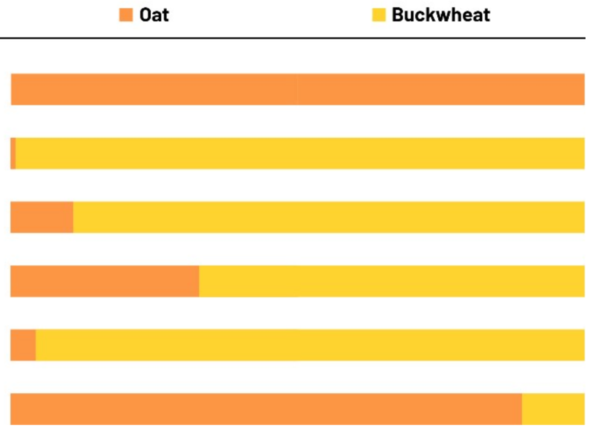


Figure 2. Illustrative summary of the most important findings

	Oat		Buckwheat	
Phytochemical	**Total content**	**Most common compound**	**Total content**	**Most common compound**
Avenanthramides	0.5 - 71.85 mg/100g	AVA-A, AVA-B and AVA-C	n.d.	n.a.
Flavonoids	n.a.	Quercetin (max 8.9 mg/100g); Rutin (max 0.47 mg/100g)	6- 507.6 mg RE/100g	Rutin (max 5,186 mg/100g); Quercetin (max 857.62 mg/100g)
Phenolics	180-576 mg RE/100g	Ferulic acids (max 149.36 mg/100g)	123-3,149 mg RE/100g	p-Anisic acid (max 1190 mg/100g)
Phytosterols	35- 68.2 mg/100g	Sitosterol (59.1-64.9%); campesterol (7.6-9.1%)	19-139 mg/100g	Sitosterol (60–70%); campesterol (5–10%)
Tocols	0.50-3.61 mg/100g	α-tocotrienol (max 5.64 mg/100g)	5.46-55.22mg/100g	γ-tocopherol (max 22.10 mg/100g)
β-glucan	5,180- 28,200 mg/100g	n.a	n.a.	1,260-3,500 mg/100g



The orange and yellow bars present maximal phytochemical content reported in oat vs. maximal phytochemical content reported in buckwheat. For example, for total phenolics, the orange bar illustrates the maximal reported total phenolic content in oat (576 mg RE/100g) and the yellow bar represents the max reported phenolic content in buckwheat (3,149 mg RE/100g).

Abbreviations: *AVA-A, AVA-B and AVA-C: Esters of 5-hydroxyanthranilic acid with p-coumaric (AVA-A), caffeic (AVA-B) and ferulic acids (AVA-C); n.a.: not available; n.d.: not detected; RE: rutin equivalents*

Supplemental table 1. Search strategy used in current review
Embase.com ('metabolism'/exp OR 'metabolomics'/exp OR 'energy metabolism'/exp OR 'metabolic activity assay'/de OR 'phytochemistry'/de OR 'phytochemical'/exp OR 'nutrient content'/de OR 'nutrient'/exp OR 'nutraceutical'/exp OR 'diet supplementation'/de OR 'pharmacokinetics'/exp OR (metabol* OR cometabol* OR co-metabol* OR nutrient* OR nutraceut* OR phytochem* OR phytopharmaceut* OR pharmacokinetic* OR ((dietary OR nutritional) NEAR/3 (supplement*))):ab,ti) OR ('alkaloid'/exp OR 'amine'/exp OR 'amino acid'/exp OR 'carbohydrate'/exp OR 'carotenoid'/exp OR 'disaccharide'/exp OR 'fatty acid'/exp OR 'flavonoid'/exp OR 'indole derivative'/exp OR 'lignan'/exp OR 'lipid'/exp OR 'monosaccharide'/exp OR 'peptide'/exp OR 'polysaccharide'/exp OR 'protein'/exp OR 'purine derivative'/exp OR 'pyrimidine derivative'/exp OR 'stilbene derivative'/de OR 'sugar alcohol'/exp OR 'terpene'/de OR 'amide'/de OR 'avenanthramide'/exp OR ("Amino acid*" OR "Cyanogenic glucoside*" OR "Fatty acid*" OR "Nucleic acid base*" OR "Organic acid*" OR "Organosulfur compound*" OR "Phenolic acid*" OR "Sugar alcohol*" OR Alkaloid* OR Alkane* OR Amine* OR Benzenoid* OR Carotenoid* OR Chlorophyll* OR Disaccharide* OR Flavonoid* OR Indole* OR Lignan* OR Monosaccharide* OR Peptide* OR Polyacetylene* OR Polysaccharide* OR Protein* OR Purine* OR Pyrimidine* OR Stilbene* OR Terpene* OR Terpenoid* OR avenanthramid* OR amide*):ab,ti) AND ('plant extract'/de OR 'plant medicinal product'/de OR 'nutrient content'/de OR 'chromatography'/exp OR 'chemistry'/exp OR (chromatogra* OR electrochromatogra* OR ((plant OR plants) NEAR/3 (extract* OR biochem* OR preparation* OR medicinal*))):ab,ti) AND ('buckwheat'/de OR 'fagopyrum'/exp OR 'oat'/de OR 'oat bran'/de OR (buckwheat* OR fagopyrum OR 'avena sativa' OR 'avena nuda' OR avena OR avenas OR ((oat OR oats) NEAR/3 (plant* OR hull* OR bran* OR kernel* OR groat*))):ab,ti) NOT ([Conference Abstract]/lim OR [Letter]/lim OR [Note]/lim OR [Editorial]/lim)
Web of Science (Core collection) TS=(((metabol* OR cometabol* OR co-metabol* OR nutrient* OR nutraceut* OR phytochem* OR phytopharmaceut* OR pharmacokinetic* OR ((dietary OR nutritional) NEAR/2 (supplement*)) OR "Amino acid*" OR "Cyanogenic glucosid*" OR "Fatty acid*" OR "Nucleic acid base*" OR "Organic acid*" OR "Organosulfur compound*" OR "Phenolic acid*" OR "Sugar alcohol*" OR Alkaloid* OR Alkane* OR Amine* OR Benzenoid* OR Carotenoid* OR Chlorophyll* OR Disaccharide* OR Flavonoid* OR Indole* OR Lignan* OR Monosaccharide* OR Peptide* OR Polyacetylene* OR Polysaccharide* OR Protein* OR Purine* OR Pyrimidine* OR Stilbene* OR Terpene* OR Terpenoid* OR avenanthramid* OR amide*) AND (chromatogra* OR electrochromatogra* OR ((plant OR plants) NEAR/3 (extract* OR biochem* OR preparation* OR medicinal*)))) AND (buckwheat* OR fagopyrum OR "avena sativa*" OR "avena nuda*" OR avena OR avenas OR ((oat OR oats) NEAR/2 (plant* OR hull* OR bran* OR kernel* OR groat*)))) AND DT=(article)
Cochrane (metabol* OR cometabol* OR co-metabol* OR nutrient* OR nutraceut* OR phytochem* OR phytopharmaceut* OR pharmacokinetic* OR ((dietary OR nutritional) NEAR/3 (supplement*)) OR "Amino acids" OR "Amino acid" OR "Cyanogenic glucoside" OR "Cyanogenic glucosides" OR "Fatty acids" OR "Fatty acid" OR "Nucleic acid base" OR "Nucleic acid bases" OR "Nucleic acid based" OR "Organic acid" OR "Organic acids" OR "Organosulfur compound" OR "Organosulfur compounds" OR "Phenolic acids" OR "Phenolic acid" OR "Sugar alcohol" OR "Sugar alcohols" OR Alkaloid* OR Alkane* OR Amine* OR Benzenoid* OR Carotenoid* OR Chlorophyll* OR Disaccharide* OR Flavonoid* OR Indole* OR Lignan* OR Monosaccharide* OR Peptide* OR Polyacetylene* OR Polysaccharide* OR Protein* OR Purine* OR Pyrimidine* OR Stilbene* OR Terpene* OR Terpenoid* OR avenanthramid* OR amide*) AND (chromatogra* OR electrochromatogra* OR ((plant OR plants) NEAR/3 (extract* OR biochem* OR preparation* OR medicinal*))) AND (buckwheat* OR fagopyrum "avena sativa" OR "avena nuda" OR avena OR avenas OR ((oat OR oats) NEAR/3 (plant* OR hull* OR bran* OR kernel* OR groat*)))
PubMed (((("Metabolism"[mh] OR "Metabolomics"[mh] OR "Energy Metabolism"[mh] OR "Phytochemicals"[mh] OR "Nutrients"[mh] OR "Dietary Supplements"[mh] OR "Pharmacokinetics"[mh] OR metabol*[tiab] OR cometabol*[tiab] OR co-metabol*[tiab] OR nutrient*[tiab] OR nutraceut*[tiab] OR phytochem*[tiab] OR phytopharmaceut*[tiab] OR pharmacokinetic*[tiab] OR ((dietary[tiab] OR nutritional[tiab]) AND (supplement*[tiab]))) OR ("Alkaloids"[mh] OR "Amines"[mh] OR "Amino acids"[mh] OR "Carbohydrates"[mh] OR "Carotenoids"[mh] OR "Disaccharides"[mh] OR "Fatty Acids"[mh] OR "Flavonoids"[mh] OR "Indoles"[mh] OR "Lignans"[mh] OR "Lipids"[mh] OR "Monosaccharides"[mh] OR "Peptides"[mh] OR "Polysaccharides"[mh] OR "Proteins"[mh] OR "Purines"[mh] OR "Pyrimidines"[mh] OR "Stilbenes"[mh] OR "Sugar Alcohols"[mh] OR "Terpenes"[mh] OR "Amides"[mh] OR Amino acid*[tiab] OR Cyanogenic glucoside*[tiab] OR Fatty acid*[tiab] OR Nucleic acid base*[tiab] OR Organic acid*[tiab] OR Organosulfur compound*[tiab] OR Phenolic acid*[tiab] OR Sugar alcohol*[tiab] OR Alkaloid*[tiab] OR Alkane*[tiab] OR Amine*[tiab] OR Benzenoid*[tiab] OR Carotenoid*[tiab] OR Chlorophyll*[tiab] OR Disaccharide*[tiab] OR Flavonoid*[tiab] OR Indole*[tiab] OR Lignan*[tiab] OR Monosaccharide*[tiab] OR Peptide*[tiab] OR Polyacetylene*[tiab] OR Polysaccharide*[tiab] OR Protein[tiab] OR Proteins[tiab] OR Purine*[tiab] OR Pyrimidine*[tiab] OR Stilbene*[tiab] OR Terpene*[tiab] OR Terpenoid*[tiab] OR avenanthramide*[tiab] OR amide*[tiab])) AND (("Plant Extracts"[mh] OR "Chromatography, Liquid"[Mesh] OR chromatogra*[tiab] OR electrochromatogra*[tiab] OR ((plant[tiab] OR plants[tiab]) AND (extract*[tiab] OR biochem*[tiab] OR preparation*[tiab] OR medicinal*[tiab])))) AND ("Fagopyrum"[mh] OR buckwheat*[tiab] OR fagopyrum[tiab] OR "Avena"[mh] OR avena sativa[tiab] OR avena nuda[tiab] OR avena[tiab] OR avenas[tiab] OR ((oat[tiab] OR oats[tiab]) AND (plant[tiab] OR plants[tiab] OR hull*[tiab] OR bran[tiab] OR brans[tiab] OR kernel*[tiab] OR groat*[tiab])))) NOT (letter[pt] OR news[pt] OR comment[pt] OR editorial[pt] OR congress[pt]))

Supplemental table 2. Flavonoids, phenolic compounds, AVAs in oat and buckwheat				
Flavonoids in oat and buckwheat				
Compound	Plant and specie (or cultivar)	Plant part	Concentration	Publication
Total flavonoids	Tartary Buckwheat	Seeds	0.037 %	(Jiang, *et al.*, 2007)
	Buckwheat	Whole grain	7mg RE/100g	(Sedej, *et al.*, 2012)
	Buckwheat	Hull	17mg RE/g	(Sedej, *et al.*, 2012)
	Buckwheat	groat	6 mg RE/100g	(Sedej, *et al.*, 2012)
	Common Buckwheat	Seeds	2.038 %	(Jiang, *et al.*, 2007)
	Common Buckwheat	Sprouts	507.6 mg RE/ 100g	(Chen, *et al.*, 2020)
	Common Buckwheat	Seed and hull	371.5- 1463.7 mg/100g	(Oomah & Mazza, 1996)
	Common buckwheat	groats	170 mg RE/100g	(Tien, *et al.*, 2018)
	Tartary buckwheat	groats	1434 mg RE/100g	(Tien, *et al.*, 2018)
Isoorientin	Common Buckwheat	Grain	0.15-7.61 mg/100g	(Terpinc, *et al.*, 2016)
	Common Buckwheat	Sprouts, microgreens, leafy greeens	751.53 mg/100g	(Sharma, 2011)
Orientin	Common Buckwheat	Sprouts, microgreens, leafy greeens	353.25 mg/100g	(Sharma, 2011)
Apigenin	Common Buckwheat	Grain	0.05-0.24 mg/100g	(Terpinc, *et al.*, 2016)
Fagopyrin	Common and Tartary Buckwheat	Leaves, flowers	19-32 mg/100g	(Habtemariam, 2019)
	Tartary buckwheat	All parts	3.06- 144.6 mg/100g	(Kočevar Glavač, *et al.*, 2017)
	Common Buckwheat	Sprouts	0.0025 to 0.041 % of dry mass	(Kreft, 2013)
	Tartary Buckwheat		0.10 to 0.12 %.	(Kreft, 2013)
Kaempferol-3-O-rutinoside	Buckwheat Daesan maemil	Seeds	3.3 mg/100g	(Lee, *et al.*, 2013)
	Buckwheat Yangjul maemil	Seeds	3.2 mg/100g	(Lee, *et al.*, 2013)
	Tartary Buckwheat	Seeds	8.2 mg/100g	(Lee, *et al.*, 2013)
Kaempferol	Tartary Buckwheat Chuanqiao 1 &2, Xiqiao 3	flour	1-3 mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	bran	2-4 mg/100g	(Peng L., 2017)
	Buckwheat	Hull, Groat	0.02 mg/100g	(Dziedzic, *et al.*, 2009)
	Tartary Buckwheat	Flowers, Leaves, Stalk, roots	0.14-0.33 mg/100g	(Dziedzic, *et al.*, 2018)
Quercetin	Oat (Mina DS)	germ, endosperm	2.4-8.9 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Mina DS)	husks	3.76-8.82 mg/100g	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	germ, endosperm	1.22-5.16 mg/100g	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	husks	0.27-4.83 mg/100g	(Keriene, *et al.*, 2015)
	Buckwheat	grain with husks	0.31-0.67 mg/100g	(Keriene, *et al.*, 2015)
	Buckwheat	husks	0.28–0.41 mg/100g	(Keriene, *et al.*, 2015)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	flour	24-72 mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	bran	62-111 mg/100g	(Peng L., 2017)
	Tartary Buckwheat (Kitawase, Hokkai T8, T9, T10)	Sprouts	1.3-47 mg/100g	(Arasu, *et al.*, 2014)
	Common Buckwheat/ Tartary Buckwheat	Bran	12.7-13.0 mg/100g	(Bai, *et al.*, 2015)
	Buckwheat	Hull, Groat	0.02-0.59 mg/100g	(Dziedzic, *et al.*, 2009)
	Tartary Buckwheat	Flowers, leaves, Stalk, roots	0.21-84.5 mg/100g	(Dziedzic, *et al.*, 2018)
	Common Buckwheat	Hull	0.02-0.07 mg/100g	(Kalinova, *et al.*, 2019)
	Common Buckwheat/ Tartary Buckwheat (Kitawase, Hokkai T9)	Seeds, Sprouts	10 mg/100g	(Kim, *et al.*, 2008)
	Common Buckwheat	Hull	0.61 mg/100g	(Quettier-Deleu, *et al.*, 2000)
	Common Buckwheat	Flour	0.15 mg/100g	(Quettier-Deleu, *et al.*, 2000)
	Common Buckwheat	Sprouts	33 mg/100 g	(Chen, *et al.*, 2020)
	Tartary buckwheat	Seed	425.65-857.62mg/100g	{Guo, 2011 #156}

	Tartary Buckwheat	Bran	330 mg/100g	(Ge & Wang, 2020)
Quercetin	Common buckwheat	Hulls, flour	0.15-0.61 mg/100g	(Quettier-Deleu, *et al.*, 2000)
	Tartary Buckwheat	All parts	0-82 mg/100g	(Kočevar Glavač, *et al.*, 2017)
	Common Buckwheat	Grain	1.19-7.69 mg/100g	(Terpinc, *et al.*, 2016)
	Common Buckwheat	Sprouts, microgreens, leafy greeens	17.12 mg/100g	(Sharma, 2011)
	Tartary buckwheat	Groats	116 mg/100g	(Tien, *et al.*, 2018)
Hyperoside	Common buckwheat	Hulls, flour	0.2-1.6 mg/100g	(Quettier-Deleu, *et al.*, 2000)
Luteolin	Common Buckwheat	Grain	0.33-4.13 mg/100g	(Terpinc, *et al.*, 2016)
Kaempferol	Common Buckwheat	Grain	0.1-0.29 mg/100g	(Terpinc, *et al.*, 2016)
Naringenin	Common Buckwheat	Grain	0.13-0.60 mg/100g	(Terpinc, *et al.*, 2016)
Quercitrin	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	flour	43-68 mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	bran	146-291 mg/100g	(Peng L., 2017)
Rutin	Buckwheat	Grain with husks	14.7–40.6 mg/100g	(Keriene, *et al.*, 2015)
	Common Buckwheat	Seed and hull	44.2-85.3 mg/100g	(Oomah & Mazza, 1996)
	Buckwheat	husks	11.3–13.98 mg/100g	(Keriene, *et al.*, 2015)
	Husked oat	Grain without husks	n.d.	(Keriene, *et al.*, 2015)
	Husked oat	husks	0.00–3.02 mg/100g	(Keriene, *et al.*, 2015)
	Oat	naked	0.22-0.47 mg/100g	{Tong, 2014 #155}
	Common oat	Grain without husks	n.d.	(Keriene, *et al.*, 2015)
	Common oat	husks	n.d.	(Keriene, *et al.*, 2015)
	Tartary Buckwheat Ishisoba	grain	1193 mg/100g	(Andrea Brunori, 2009)
	Tartary Buckwheat golden	grain	1041mg/100g	(Andrea Brunori, 2009)
	Tartary Buckwheat Donan	grain	979 mg/100g	(Andrea Brunori, 2009)
	Common buckwheat	hull	80-440 mg/100g	(Steadman, *et al.*, 2001)
	Common Buckwheat	Sprouts, microgreens, leafy greeens	1440.92 mg/100g	(Sharma, 2011)
	Common Buckwheat	Bran	20-30 mg/100g	(Steadman, *et al.*, 2001)
	Common Buckwheat	groat	18 mg/100g	(Steadman, *et al.*, 2001)
	Tartary Buckwheat	groat	84 mg/100g	(Steadman, *et al.*, 2001)
	Common Buckwheat	hulls	84 mg/100g	(Steadman, *et al.*, 2001)
	Tartary Buckwheat	hulls	437 mg/100g	(Steadman, *et al.*, 2001)
	Buckwheat	whole grain	14.6 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	hull	22.5 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	groat	11.6 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat Daesan maemil	Seeds	45.0 mg/100g	(Lee, *et al.*, 2013)
	Buckwheat Yangjul maemil	Seeds	26.6 mg/100g	(Lee, *et al.*, 2013)
	Tartary Buckwheat	Seeds	204.0 mg/100g	(Lee, *et al.*, 2013)
	Tartary Buckwheat	seeds	810–1700 mg/100g	(Fabjan, *et al.*, 2003)
	Common Buckwheat	seeds	10mg/100g	(Fabjan, *et al.*, 2003)
	Tartary Buckwheat	Flower, leaf, Stalk	52.38-294.9 mg/100g	(Dziedzic, *et al.*, 2018)
	Common/Tartary Buckwheat	Flower. leaf, stalk, seed	0.42-7.77% [a]	(Zielińska, *et al.*, 2012)
	Tartary Buckwheat (Kitawase, Hokkai T8, T9, T10)	Sprouts	329-4793 mg/100g	(Arasu, *et al.*, 2014)
	Tartary Buckwheat/ Common Buckwheat	Bran	0.33 mg/100g	(Bai, *et al.*, 2015)
	Common Buckwheat/Tartary Buckwheat (Kitawase, Hokkai T9)	Seeds, sprouts	20-2380 mg/100g	(Kim, *et al.*, 2008)
	Common Buckwheat	Sprouts	719 mg/ 100g	(Chen, *et al.*, 2020)
	Common Buckwheat	Flour	12.7 mg/100g	(Danila, *et al.*, 2007)
	Buckwheat	Hull, Groat	0.7-3.59 mg/100g	(Dziedzic, *et al.*, 2009)
	Common Buckwheat	Seeds	1400-18850 mg/100g	(A. R. Gulpinar, *et al.*, 2012)
	Common Buckwheat	Hull	0.76-0.98 mg/100g	(Kalinova, *et al.*, 2019)
	Common Buckwheat	Hull	5.21 mg/100g	(Quettier-Deleu, *et al.*, 2000)
	Common Buckwheat	Flour	2.28 mg/ 100g	(Quettier-Deleu, *et al.*, 2000)
	Husked oat	husks	0.00-3.02 mg/100g	(Keriene, *et al.*, 2015)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Flour	849-1486 mg/100g	(Peng L., 2017)
	Tartary buckwheat	Seed	518.54-1325.59 mg/100g	{Guo, 2011 #156}
	Tartary Buckwheat	Bran	4079-5186mg/100g	(Peng L., 2017)

	Chuanqiao 1&2, Xiqiao 3			
	Tartary Buckwheat	Bran	332.9 mg/100g	(Ge & Wang, 2020)
	Common Buckwheat	Leaves, flowers	822-3417 mg/100g	(Habtemariam, 2019)
	Common Buckwheat	Flowers	568 mg/100g	(Kraujaliene, *et al.*, 2017)
	Common Buckwheat	Seeds	54.2 mg/ 100g	(Park, *et al.*, 2019)
Rutin	Tartary Buckwheat	All parts	157-3245mg/100g	(Kočevar Glavač, *et al.*, 2017)
	Common Buckwheat	Grains	0.25-33.0 mg/100 g	(Hung & Morita, 2008)
	Common buckwheat	Hulls, flour	2.28- 5.205 mg/100g	(Quettier-Deleu, *et al.*, 2000)
Epicatechin	Common buckwheat	Hulls, flour	1.15-3.4 mg/100g	(Quettier-Deleu, *et al.*, 2000)
Epicatechin gallate	Common buckwheat	Hulls, flour	0.88 mg/100g	(Quettier-Deleu, *et al.*, 2000)
Catechin	Tartary buckwheat	Seed	8.89-19.96 mg/100g	{Guo, 2011 #156}
Phenolics				
Compound	Plant	Plant part	Concentration	Author
Total phenolics	Oat (Mina DS)	Germ, endosperm	180 mg RE/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Mina DS)	Hull (or husks)	265 mg RE/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	Germ, endosperm	286 mg RE/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	Hull (or husks)	576 mg RE/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	35.1-87.4 mg/100g	(Shewry, *et al.*, 2008)
	Oat (Ogle)	Germ, endosperm, bran, hull	23.2 mg/100g	(Xing & White, 1997)
	Oat (Ogle)	Hull	35.1 mg/100g	(Xing & White, 1997)
	Oat (Wild oat, SH430, M73)	Germ, endosperm, bran, hull	0.14-0.16 mg (per seed)	(Gallagher, *et al.*, 2010)
	Oat (13 cultivars)	Germ, endosperm, bran, hull	3.57-14.35 mg/100g	(Chen, *et al.*, 2018)
	Oat (8 cultivars)	Germ, endosperm, bran, hull	120.1-168.4 mg/100g	(Multari, *et al.*, 2018)
	Common Buckwheat	grain with husks	1020 mg RE/100g	(Keriene, *et al.*, 2015)
	Common Buckwheat	husks	1410 mg RE/100g	(Keriene, *et al.*, 2015)
	Oat (commercial)	Bran	2.52 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial), thermally processed	Bran	3.17 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (22 commercial varieties)	Seeds and bran	64.5-151.8 mg/100 g	(Soycan, *et al.*, 2019)
	Oat		113.8 mg GAE/100g	(Holasovaa, *et al.*, 2002)
	Buckwheat	seeds	330.3 GAE/100g	(Holasovaa, *et al.*, 2002)
	uckwheat	Dehulled seeds	390.3 GAE/100g	(Holasovaa, *et al.*, 2002)
	uckwheat	leaves	3.951.4 mg GAE/100g	(Holasovaa, *et al.*, 2002)
	Common Buckwheat	groat	244 mg/100g****	(Steadman, *et al.*, 2001)
	Common Buckwheat	whole grain	142 mg/100g***	(Sedej, *et al.*, 2012)
	Common Buckwheat	hull	220 mg/100g***	(Sedej, *et al.*, 2012)
	Common Buckwheat	groat	141 mg/100g***	(Sedej, *et al.*, 2012)
	Common Buckwheat	Seed milling fractions	1548 mg/100g****	(Steadman, *et al.*, 2001)
	Common Buckwheat	Seed, steam, aerial parts	9030-30100 mg/100g***	(A. R. Gulpinar, *et al.*, 2012)
	Common Buckwheat	Sprouts	778.6 mg/ 100g***	(Chen, *et al.*, 2020)
	Tartary Buckwheat	Bran, flour	123 mg RE/ 100g	(Ge & Wang, 2020)
	Common Buckwheat	Seeds	537 mg GAE/ 100g	(Liu, *et al.*, 2019)
	Tartary Buckwheat	Seeds	667 mg GAE/100g	(Liu, *et al.*, 2019)
	Common Buckwheat	Seeds	177.7 mg/100g	(Rocchetti, *et al.*, 2019)
	Common Buckwheat	Seeds	1495 mg/100g	(Siwatch, *et al.*, 2019)
	Common buckwheat	Seeds, Sprouts	64.5-670 mg/100g**	(Alvarez-Jubete, *et al.*, 2010)
	Common buckwheat	groats	773 mg FAE/100g	(Tien, *et al.*, 2018)
	Tartary buckwheat	groats	1927 mg FAE/100g	(Tien, *et al.*, 2018)
	Common buckwheat	Hull, seed, dehulled seed	280- 513.18 chlorogenic acid equivalents/100g	(Dziadek, *et al.*, 2016)
	Oat	naked	101.7 to 151.9 mg/100g	{Tong, 2014 #155}
	Common buckwheat	hulls, brans and flour	1386-2487 GAE mg/100g	(Li, *et al.*, 2013)
4-hydrobenzoic acid	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.62-5.06 mg/100g	(Shewry, *et al.*, 2008)
	Oat (Wild oat, SH430, M73)	Germ, endosperm, bran, hull	0.0004-0.0007 mg (per seed)	(Gallagher, *et al.*, 2010)
	Oat (13 cultivars)	Germ, endosperm, bran, hull	0.67-2.37 mg/100g	(Chen, *et al.*, 2018)
	Oat (22 commercial varieties)	Seeds and bran	0.2-1.55 mg/100 g	(Soycan, *et al.*, 2019)
	Oat	bran	2.2 mg/1006	(Mattila, *et al.*, 2005)
	Oat (20 varieties)	Seeds	0.54 mg/100g	(Varga, *et al.*, 2018)
	Oat (20 varieties)	Hull	2.25 mg/100g	(Varga, *et al.*, 2018)
	Tartary Buckwheat	Flowers, leaves, stalk,	0.07-0.14 mg/100g	(Dziedzic, *et al.*, 2018)

		roots		
	Tartary buckwheat	Seed	2.22- 8.78 mg/100g	{Guo, 2011 #156}
gallic acid	Buckwheat	Hull, Groat	0.02-0.17 mg/100g	(Dziedzic, *et al.*, 2009)
	Tartary Buckwheat	Flower, leaf, root	0.08-0.73 mg/100g	(Dziedzic, *et al.*, 2018)
	Oat (13 cultivars)	Germ, endosperm, bran, hull	1.43-7.05 mg/100g	(Chen, *et al.*, 2018)
	Common Buckwheat	Seeds	0.28 mg/100g	(Liu, *et al.*, 2019)
	Tartary Buckwheat	Seeds	0.65 mg/100g	(Liu, *et al.*, 2019)
	Common Buckwheat	Seeds	0.98 mg/100g	(Park, *et al.*, 2019)
	Buckwheat	seed	0.48-0.62 mg/100g	{Guo, 2011 #156}
	Common Buckwheat	Grain	0.07-0.19 mg/100g	(Terpinc, *et al.*, 2016)
Chlorogenic acid	Tartary Buckwheat	Flower, leaf, root	0.21-101.34 g/100g	(Dziedzic, *et al.*, 2018)
	Oat	naked	0.20 mg/100g	{Tong, 2014 #155}
	Tartary Buckwheat (Kitawase, Hokkai T8, T9, T10)	Sprouts	162-377mg/100g	(Arasu, *et al.*, 2014)
	Tartary Buckwheat	Flowers, Leaves, stalk, roots	2.13-101 mg/100g	(Dziedzic, *et al.*, 2018)
	Common Buckwheat/Tartary Buckwheat (Kitawase, Hokkai T9)	Seeds, sprouts	80-170 mg/100g	(Kim, *et al.*, 2008)
	Common Buckwheat	Seeds	0.26-1.26 mg/100g	(Kiprovski, *et al.*, 2015)
	Common Buckwheat	Sprouts, microgreens, leafy greeens	156.23 mg/100g	(Sharma, 2011)
	Common Buckwheat	Flowers	124.7 mg/100g	(Kraujaliene, *et al.*, 2017)
	Common Buckwheat	Seeds	1.15 mg/100g	(Liu, *et al.*, 2019)
	Tartary Buckwheat	Seeds	0.57 mg/ 100g	(Liu, *et al.*, 2019)
	Common Buckwheat	Seeds	11.0 mg/100g	(Park, *et al.*, 2019)
	Common and tartary buckwheat		3.1-16.6 mg/100g	(Sytar, 2014)
vanillic acid	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.39-9.38 mg/100g	(Shewry, *et al.*, 2008)
	Oat (Mina DS)	Germ, endosperm	0.26 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat	bran	0.4 mg/1006	(Mattila, *et al.*, 2005)
	Oat (Mina DS)	Hull (or husks)	1.12 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	Germ, endosperm	0.34 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	Hull (or husks)	0.89 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Ogle)	Germ, endosperm, bran, hull	0.34 mg/100g	(Xing & White, 1997)
	Oat (Ogle)	Hull	5.42 mg/100g	(Xing & White, 1997)
	Oat	naked	0.51 mg/100g	{Tong, 2014 #155}
	Oat (Wild oat, SH430, M73)	Germ, endosperm, bran, hull	0.0007-0.0014 mg (per seed)	(Gallagher, *et al.*, 2010)
	Oat (13 cultivars)	Germ, endosperm, bran, hull	037-4.75 mg/100g	(Chen, *et al.*, 2018)
	Oat (unspecified)	hull	593 mg/100g (fermented)	(Garleb, *et al.*, 1991)
	Oat (8 cultivars)	Germ, endosperm, bran, hull	0.46-0.71 mg/100g	(Multari, *et al.*, 2018)
	Oat (commercial)	Bran	1.01 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial), thermally processed	Bran	1.25 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (22 commercial varieties)	Seeds and bran	0.49-1.29 mg/100 g	(Soycan, *et al.*, 2019)
	Oat (20 varieties)	Seeds	0.81 mg/100g	(Varga, *et al.*, 2018)
	Oat (20 varieties)	Hull	20.6 mg/100g	(Varga, *et al.*, 2018)
	Buckwheat	whole grain	1.5 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	hull	3.71 mg/100g	(Sedej, *et al.*, 2012)
	Common Buckwheat	Hull	0.03-0.05 mg/100g	(Kalinova, *et al.*, 2019)
	Buckwheat	seed	0.21-1.6 mg/100g	{Guo, 2011 #156}
	Common and tartary buckwheat		221.1- 311.7 mg/100g	(Sytar, 2014)
syringic acid	Buckwheat	whole grain	5.23 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	hull	3.63 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	groat	6.35 mg/100g	(Sedej, *et al.*, 2012)
	Oat	bran	2.8 mg/1006	(Mattila, *et al.*, 2005)
	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.46-0.79 mg/100g	(Shewry, *et al.*, 2008)
	Oat (Mina DS)	Germ, endosperm	0.34 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Mina DS)	Hull (or husks)	0.68 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	Germ, endosperm	0.55 mg/100g[a]	(Keriene, *et al.*, 2015)

	Oat (Migla DS)	Hull (or husks)	0.43 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (8 cultivars)	Germ, endosperm, bran, hull	0.39-0.89 mg/100g	(Multari, *et al.*, 2018)
	Oat (22 commercial varieties)	Seeds and bran	0.45-2.11 mg/100 g	(Soycan, *et al.*, 2019)
	Oat (20 varieties)	Seeds	0.49 mg/100g	(Varga, *et al.*, 2018)
	Oat (20 varieties)	Hull	3.88 mg/100g	(Varga, *et al.*, 2018)
	Tartary Buckwheat	Flower, leaf, root	0.12-0.56mg/100g	(Dziedzic, *et al.*, 2018)
	Buckwheat	seed	0.12-0.18mg/100g	{Guo, 2011 #156}
	Common Buckwheat	Seeds	0.37 mg/ 100g	(Liu, *et al.*, 2019)
	Tartary Buckwheat	Seeds	0.19 mg/100g	(Liu, *et al.*, 2019)
syringaldehyde	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.32-2.12 mg/100g	(Shewry, *et al.*, 2008)
	Oat (unspecified)	hull	566 mg/100g (fermented)	(Garleb, *et al.*, 1991)
	Oat (8 cultivars)	Germ, endosperm, bran, hull	0.11-0.17 mg/100g	(Multari, *et al.*, 2018)
caffeic acid	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm	0.52-1.57 mg/100g	(Shewry, *et al.*, 2008)
	Oat (Ogle)	Germ, endosperm, bran, hull	1.68 mg/100g	(Xing & White, 1997)
	Oat (Ogle)	Hull	-	(Xing & White, 1997)
	Oat (13 cultivars)	Germ, endosperm, bran, hull	0.09-0.70 mg/100g	(Chen, *et al.*, 2018)
	Oat (commercial)	Bran	0.86 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial), thermally processed	Bran	2.28 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat	grains	0.2-23.9 nmol/g	(Skoglund, *et al.*, 2008)
	Oat (22 commercial varieties)	Seeds and bran	1.04-7.27 mg/100 g	(Soycan, *et al.*, 2019)
	Oat (20 varieties)	Seeds	0.86 mg/100g	(Varga, *et al.*, 2018)
	Oat (20 varieties)	Hull	0.42 mg/100g	(Varga, *et al.*, 2018)
	Common Buckwheat	fiber	1.12 mg/100g	(Wefers & Bunzel, 2015)
	Tartary Buckwheat	Flower, leaf, root	0.29-1.84 mg/100g	(Dziedzic, *et al.*, 2018)
	Buckwheat	seed	0.12-0.49 mg/100g	{Guo, 2011 #156}
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	flour	22-47 mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	bran	65-119 mg/100g	(Peng L., 2017)
	Common Buckwheat	Seeds	9.11 mg/ 100g	(Park, *et al.*, 2019)
	Oat	bran	0.5 mg/1006	(Mattila, *et al.*, 2005)
	Common buckwheat	Seeds, sprouts	8.8-15.1 umol/100g	(Alvarez-Jubete, *et al.*, 2010)
	Buckwheat	Hull, Groat	0.04 mg/100g	(Dziedzic, *et al.*, 2009)
	Tartary Buckwheat	Flowers, leaves, stalk, roots	0.29-1.84 mg/100g	(Dziedzic, *et al.*, 2018)
	Common Buckwheat	Grains	0.12-3.34 mg/100g	(Terpinc, *et al.*, 2016)
sinapic acid	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.91-1.03 mg/100g[a]	(Shewry, *et al.*, 2008)
	Oat	bran	9 mg/1006	(Mattila, *et al.*, 2005)
	Oat (Mina DS)	Germ, endosperm	2.4 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Mina DS)	Hull (or husks)	0.14 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	Germ, endosperm	2.81 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	Hull (or husks)	0.27 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Ogle)	Hull	0.56 mg/100g	(Xing & White, 1997)
	Oat (commercial)	Bran	0.47 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial), thermally processed	Bran	0.53 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (22 commercial varieties)	Seeds and bran	1.89-8.03 mg/100 g	(Soycan, *et al.*, 2019)
	Buckwheat	Hull, Groat	0.41 mg/100g	(Dziedzic, *et al.*, 2009)
	Buckwheat	whole grain	2.81 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	hull	2.98 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	groat	3.04 mg/100g	(Sedej, *et al.*, 2012)
	Common Buckwheat	fibre	3.24 mg/100g	(Wefers & Bunzel, 2015)
	Common Buckwheat	Seeds	0.35 mg/100g	(Liu, *et al.*, 2019)
ferulic acid	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.66-0.84 mg/100g	(Shewry, *et al.*, 2008)
	Oat (Mina DS)	Germ, endosperm	9.87 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat	Grain	16.50-149.36 mg/100g	(Kovacova & MaliNoVá, 2007)

	Oat	naked	0.23 mg/100g	{Tong, 2014 #155}
	Oat (Mina DS)	Hull (or husks)	30.9 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat	bran	14 mg/1006	(Mattila, *et al.*, 2005)
	Oat	grain	0.07-0.6 mg/100g	(Dokuyucu, *et al.*, 2003)
	Oat (Migla DS)	Germ, endosperm	10.5 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	Hull (or husks)	45.85 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Ogle)	Germ, endosperm, bran, hull	14.7 mg/100g	(Xing & White, 1997)
	Oat (Ogle)	Hull	14.2 mg/100g	(Xing & White, 1997)
	Oat (Wild oat, SH430, M73)	Germ, endosperm, bran, hull	0.09-0.13 mg (per seed)	(Gallagher, *et al.*, 2010)
	Oat (13 cultivars)	Germ, endosperm, bran, hull	0.14-1.89 mg/100g	(Chen, *et al.*, 2018)
	Oat (unspecified)	hull	214 mg/100g (fermented)	(Garleb, *et al.*, 1991)
	Oat (8 cultivars)	Germ, endosperm, bran, hull	53.2-82.9 mg/100g	(Multari, *et al.*, 2018)
	Oat (commercial)	Bran	0.46 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial), thermally processed	Bran	0.49 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (22 commercial varieties)	Seeds and bran	15.2-115.3 mg/100g	(Soycan, *et al.*, 2019)
	Oat (20 varieties)	Seeds	32.7 mg/100g	(Varga, *et al.*, 2018)
	Oat (20 varieties)	Hull	809.5 mg/100g	(Varga, *et al.*, 2018)
	Oat	bran	33.0 mg/1006	(Mattila, *et al.*, 2005)
	Buckwheat	whole grain	1.72 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	hull	1.75 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	groat	1.74 mg/100g	(Sedej, *et al.*, 2012)
	Common and tartary buckwheat		5.6-7.3 mg/100g	(Sytar, 2014)
	Common Buckwheat	fibre	4.42 mg/100g	(Wefers & Bunzel, 2015)
	Tartary Buckwheat	Flower, leaf, root	0.32-1.18 mg/100g	(Dziedzic, *et al.*, 2018)
	Common Buckwheat	Seeds	0.89 mg/100g	(Liu, *et al.*, 2019)
	Common Buckwheat	Grains	0.17-42.8 µg/g	(Hung & Morita, 2008)
	Buckwheat	seed	1.86-7.29mg/100g	{Guo, 2011 #156}
Cis-ferulic acid	Common Buckwheat	fibre	0.93 mg/100g	(Wefers & Bunzel, 2015)
Trans-ferulic acid	Common and tartary buckwheat		31.7-65.7mg/100g	(Sytar, 2014)
p-anisic	Common and tartary buckwheat		744.5-1190 mg/100g	(Sytar, 2014)
Methoxy-cinnamic acid	Common and tartary buckwheat		14.1-74.7 mg/100g	(Sytar, 2014)
p -coumaric acid	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.24-1.19 mg/100g	(Shewry, *et al.*, 2008)
	Oat	bran	1.2 mg/1006	(Mattila, *et al.*, 2005);
	Oat	grain	0.12-0.19 mg/100g	(Dokuyucu, *et al.*, 2003)
	Oat (Mina DS)	Germ, endosperm	0.57 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Mina DS)	Hull (or husks)	26.9 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	Germ, endosperm	1.13 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat (Migla DS)	Hull (or husks)	39.9 mg/100g[a]	(Keriene, *et al.*, 2015)
	Oat	grains	0.3-29.7 nmol/g	(Skoglund, *et al.*, 2008)
	Oat (Ogle)	Germ, endosperm, bran, hull	4.49 mg/100g	(Xing & White, 1997)
	Oat (Ogle)	Hull	59.7 mg/100g	(Xing & White, 1997)
	Oat (Wild oat, SH430, M73)	Germ, endosperm, bran, hull	0.02-0.04 mg (per seed)	(Gallagher, *et al.*, 2010)
	Oat (unspecified)	hull	245 mg/100g (fermented)	(Garleb, *et al.*, 1991)
	Oat (8 cultivars)	Germ, endosperm, bran, hull	59.0-82.6 mg/100g	(Multari, *et al.*, 2018)
	Oat (commercial)	Bran	0.26 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial), thermally processed	Bran	0.30 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (22 commercial varieties)	Seeds and bran	0.19-4.94 mg/100 g	(Soycan, *et al.*, 2019)
	Oat (20 varieties)	Seeds	6.22 mg/100g	(Varga, *et al.*, 2018)
	Oat (20 varieties)	Hull	368 mg/100g	(Varga, *et al.*, 2018)
	Common Buckwheat	fiber	3.01 mg/100g	(Wefers & Bunzel, 2015)
	Buckwheat	seed	0.23-0.68mg/100g	{Guo, 2011 #156}
	Tartary Buckwheat	Flower, leaf, root	0.08-1.69 mg/100g	(Dziedzic, *et al.*, 2018)
	Buckwheat	Hull, Groat	0.07-0.29 mg/100g	(Dziedzic, *et al.*, 2009)
Cis- p-coumaric acid	Common Buckwheat	fibre	0.589 mg/100g	(Wefers & Bunzel, 2015)
coumaric	Oat	grain	8.05-210.27 mg/100 g	(Kovacova & MaliNoVá,

				2007)
Ferulic acid	Oat	grains	0.4-15.4 nmol/l	(Skoglund, *et al.*, 2008)
o-coumaric acid	Oat (Ogle)	Hull	0.69 mg/100g	(Xing & White, 1997)
	Oat (8 cultivars)	Germ, endosperm, bran, hull	0.11-0.38 mg/100g	(Multari, *et al.*, 2018)
2-hydroxycinnamic acid	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.05-0.67 mg/100g	(Shewry, *et al.*, 2008)
2,4-dihydrobenzoic acid (Protocatechuic acid)	Oat (13 cultivars)	Germ, endosperm, bran, hull	0.10-1.04 mg/100g	(Chen, *et al.*, 2018)
	Buckwheat	whole grain	9.26 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	hull	16.8 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	groat	10.3 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat	seed	1.71-4.63mg/100g	{Guo, 2011 #156}
	Common Buckwheat	Hull	0.18-0.21 mg/100g	(Kalinova, *et al.*, 2019)
	Common Buckwheat	Seeds	0.4 mg/100g	(Liu, *et al.*, 2019)
	Tartary Buckwheat	Seeds	1.0 mg/100g	(Liu, *et al.*, 2019)
	Oat (Cacko)	Germ, endosperm, bran, hull	0.50 mg/100g	(Shewry, *et al.*, 2008)
	Oat (commercial)	Bran	5.50 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial), thermally processed	Bran	7.62 mg/100g	(Călinoiu & Vodnar, 2020)
Vitexin	Tartary Buckwheat (Kitawase, Hokkai T8,T9,T10)	Sprouts	45-645 mg/100g	(Arasu, *et al.*, 2014)
	Tartary Buckwheat	Flowers, leaves, stalk, root	0.33-4.22 mg/100g	(Dziedzic, *et al.*, 2018)
	Common Buckwheat	Hull	0.69-1.2 mg/100g	(Kalinova, *et al.*, 2019)
	Common Buckwheat/Tartary Buckwheat (Kitawase, Hokkai T9)	Seeds, Sprouts	20-630 mg/100g	(Kim, *et al.*, 2008)
	Common Buckwheat	Seeds	0.25-3.28 mg/100g	(Kiprovski, *et al.*, 2015)
	Tartary Buckwheat	flour	1-3 mg/100g	(Peng L., 2017)
	Tartary Buckwheat	bran	4-9 mg/ 100g	(Peng L., 2017)
	Common Buckwheat	Sprouts	463 mg/ 100g	(Chen, *et al.*, 2020)
	Common Buckwheat	Sprouts, microgreens, leafy greeens	581.27 mg/100g	(Sharma, 2011)
isovitexin	Common Buckwheat	Sprouts, microgreens, leafy greeens	370.14 mg/100g	(Sharma, 2011)
Avenanthramides				
Compound	Plant (Cultivar)	Plant parts	Concentration	Author
Total avenanthramides (AVAs)	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	4.20-9.10 mg/100g[a]	(Shewry, *et al.*, 2008)
	Oat (13 cultivars)	Germ, endosperm, bran, hull	0.50-21.43 mg/100g	(Chen, *et al.*, 2018)
	Oat (8 cultivars)	Germ, endosperm, bran, hull	1.12-8.39 mg/100g	(Multari, *et al.*, 2018)
	Oat (commercial)	Bran	0.79-13.3 mg/100g	(Hu, *et al.*, 2019)
	Oat	naked	3.73- 71.85mg/100g	{Tong, 2014 #155}
AVA 2c	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	1.58-4.49 mg/100g[a]	(Shewry, *et al.*, 2008)
	Oat (Matilda, Sang, Freja)	Germ, endosperm, bran, hull	74-115 nmol/g	(Dimberg, *et al.*, 2005)
	Oat (Gem, Vista)	Leaves, spikelet, germ, endosperm, bran, hull	4.02-7.8 nmol/g	(D. M. Peterson & Dimberg, 2008)
	Oat (10 commercial brands)	Germ, endosperm, bran, hull	1.1-1.6 mg/100g	(Pridal, *et al.*, 2018)
	Oat (10 commercial brands)	Bran	0.9-2.9 mg/100g	(Pridal, *et al.*, 2018)
	Oat (10 commercial brands), rolled oats	Germ, endosperm, bran, hull	0.7-2.1 mg/100g	(Pridal, *et al.*, 2018)
	Oat (13 cultivars)	Germ, endosperm, bran, hull	0.16-7.00 mg/100g	(Chen, *et al.*, 2018)
	Oat (8 cultivars)	Germ, endosperm, bran, hull	0.35-3.92 mg/100g	(Multari, *et al.*, 2018)
	Oat (commercial)	Bran	0.41 mg/100g	(Călinoiu & Vodnar, 2020)

	Oat	naked	1.85 mg/100g	{Tong, 2014 #155}
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	Oat (commercial), thermally processed	Bran	0.63 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial)	Bran	0.07-1.49 mg/100g	(Hu, *et al.*, 2019)
	Oat (20 varieties)	Seeds	0.66 mg/100g	(Varga, *et al.*, 2018)
	Oat (20 varieties)	Hull	6.37 mg/100g	(Varga, *et al.*, 2018)
	Oat	Hulls, groats	0.11 mg/100g	(Ortiz-Robledo, *et al.*, 2013)
	Oat	Flakes, whole grain	0.4-0.9 mg/1006	(Mattila, *et al.*, 2005);
	Oat	grain	0.6-2.9 mg/100g	(Dokuyucu, *et al.*, 2003)
AVA 2p	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	1.3-3.0 mg/100g[a]	(Shewry, *et al.*, 2008)
	Oat (Matilda, Sang, Freja)	Germ, endosperm, bran, hull	78-120 nmol/g	(Dimberg, *et al.*, 2005)
	Oat (Gem, Vista)	Leaves, spikelet, germ, endosperm, bran, hull	3.93-74.26 nmol/g	(D. M. Peterson & Dimberg, 2008)
	Oat (10 commercial brands)	Germ, endosperm, bran, hull	0.6-1.5 mg/100g	(Pridal, *et al.*, 2018)
	Oat (10 commercial brands)	Bran	0.7-1.6 mg/100g	(Pridal, *et al.*, 2018)
	Oat (10 commercial brands), rolled oats	Germ, endosperm, bran, hull	0.6-1.9 mg/100g	(Pridal, *et al.*, 2018)
	Oat (13 cultivars)	Germ, endosperm, bran, hull	0.23-7.45 mg/100g	(Chen, *et al.*, 2018)
	Oat (8 cultivars)	Germ, endosperm, bran, hull	0.60-3.96 mg/100g	(Multari, *et al.*, 2018)
	Oat	Hulls, groats	0.15 mg/100g	(Ortiz-Robledo, *et al.*, 2013)
	Oat (commercial)	Bran	0.70 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial), thermally processed	Bran	0.87 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial)	Bran	0.06-3.32 mg/100g	(Hu, *et al.*, 2019)
	Oat	Flakes, whole grain	0.4-0.9 mg/1006	(Mattila, *et al.*, 2005);
	Oat	grain	0.3-1.9 mg/100g	(Dokuyucu, *et al.*, 2003)
	Oat (20 varieties)	Seeds	2.56 mg/100g	(Varga, *et al.*, 2018)
	Oat (20 varieties)	Hull	2.48 mg/100g	(Varga, *et al.*, 2018)
AVA 2f	Oat	Hulls, groats	0.12 mg/100g	(Ortiz-Robledo, *et al.*, 2013)
	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	1.27-2.40 mg/100g[a]	(Sterna, *et al.*, 2014)
	Oat (Matilda, Sang, Freja)	Germ, endosperm, bran, hull	62-65 nmol/g	(Dimberg, *et al.*, 2005)
	Oat (Gem, Vista)	Leaves, spikelet, germ, endosperm, bran, hull	3.35-18.16 nmol/g	(D. M. Peterson & Dimberg, 2008)
	Oat (10 commercial brands)	Germ, endosperm, bran, hull	0.9-2.3 mg/100g	(Pridal, *et al.*, 2018)
	Oat (10 commercial brands)	Bran	1.0-2.8 mg/100g	(Pridal, *et al.*, 2018)
	Oat (10 commercial brands), rolled oats	Germ, endosperm, bran, hull	0.6-2.2 mg/100g	(Pridal, *et al.*, 2018)
	Oat (13 cultivars)	Germ, endosperm, bran, hull	0.11-6.97 mg/100g	(Chen, *et al.*, 2018)
	Oat (8 cultivars)	Germ, endosperm, bran, hull	0.47-2.19 mg/100g	(Multari, *et al.*, 2018)
	Oat (commercial)	Bran	0.78 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial), thermally processed	Bran	0.91 mg/100g	(Călinoiu & Vodnar, 2020)
	Oat (commercial)	Bran	0.05-6.62 mg/100g	(Hu, *et al.*, 2019)
	Oat	Flakes, whole grain	0.4-0.9 mg/1006	(Mattila, *et al.*, 2005)
	Oat	grain	0.3-2.8 mg/100g	(Dokuyucu, *et al.*, 2003)
	Oat (20 varieties)	Seeds	2.18 mg/100g	(Varga, *et al.*, 2018)
	Oat (20 varieties)	Hull	3.03 mg/100g	(Varga, *et al.*, 2018)

Compound	Plant	Plant part	Concentration	Author
Total tocols	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	1.61-3.61 mg/100g[a]	(Shewry, *et al.*, 2008)
	Oat (12 cultivars)[b]	Germ, endosperm, bran	1.9 to 3.0 mg /100g[c]	(D.M. Peterson & Qureshi, 1993)
	Oat (unspecified)[d]	Germ, endospore, bran	7.21 mg/100g	(Panfili, *et al.*, 2003)
	Oat (Slawko)	Germ, endospore, bran	0.5 mg/100g	(Zielinski, *et al.*, 2001)
	Buckwheat Kora	whole grain	5.46 mg/100g	(Zielinski, *et al.*, 2001)
	Buckwheat Kora,	endosperm with embryo	6.44 mg/100g	(Zielinski, *et al.*, 2001)
	Buckwheat Mancan variety	seed	55.22mg/100g	(Przybylski, *et al.*, 1998)
Trienols	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	1.09-2.57 mg/100g	(Shewry, *et al.*, 2008)
	Oat (Slawko)	Germ, endospore	1.35 mg/100g	(Zielinski, *et al.*, 2001)
α-T	Buckwheat	whole grain, hull, groat	3.32-9.44 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat Kora	whole grain	0.09 mg/100g	(Zielinski, *et al.*, 2001)
	Buckwheat Kora	endosperm with embryo	0.19 mg/100g	(Zielinski, *et al.*, 2001)
	Buckwheat Mancan variety	seed	38.01 mg/100g	(Przybylski, *et al.*, 1998)
	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.45-0.98 mg/100g	(Shewry, *et al.*, 2008)
	Oat (12 cultivars)[b]	Germ, endosperm, bran	0.72 – 0.94 mg/100g[c]	(D.M. Peterson & Qureshi, 1993)
	Oat (unspecified) [d]	Germ, endospore, bran	1.49 mg/100g	(Panfili, *et al.*, 2003)
	Oat (Slawko)	Germ, endospore	0.09 mg/100g	(Zielinski, *et al.*, 2001)
	Oat (BDMY6, BDMY7, Che-chois, Y2330)	Germ, endosperm, bran, hull	0.56-4.14 mg/100g	(Musa Ozcan, *et al.*, 2006)
α-T3	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.94-2.30 mg/100g	(Shewry, *et al.*, 2008)
	Oat (12 cultivars)[b]	Germ, endosperm, bran	0.09- 0.19 mg/100g[c]	(D.M. Peterson & Qureshi, 1993)
	Oat (unspecified) [d]	Germ, endospore, bran	5.64 mg/100g	(Panfili, *et al.*, 2003)
	Oat (Slawko)	Germ, endospore	0.27 mg/100g	(Zielinski, *et al.*, 2001)
β-T	Buckwheat Mancan variety	seed	1.65 mg/100g	(Przybylski, *et al.*, 1998)
	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.06-0.10 mg/100g	(Shewry, *et al.*, 2008)
	Oat (12 cultivars) [b]	Germ, endosperm, bran	0.07-0.13 mg/100g[c]	(D.M. Peterson & Qureshi, 1993)
	Oat (unspecified) [d]	Germ, endospore, bran	0.3 mg/100g	(Panfili, *et al.*, 2003)
	Oat (Slawko)	Germ, endospor	0.08 mg/100g	(Zielinski, *et al.*, 2001)
	Oat (BDMY6, BDMY7, Che-chois, Y2330)	Germ, endosperm, bran, hull	0.08-0.84 mg/100g	(Musa Ozcan, *et al.*, 2006)
β-T3	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.13-0.27 mg/100g	(Shewry, *et al.*, 2008)
	Oat (12 cultivars)[b]	Germ, endosperm, bran	0.05- 0.15 mg/100g[c]	(D.M. Peterson & Qureshi, 1993)
	Oat (unspecified) [d]	Germ, endospore, bran	0.54 mg/ 100g	(Panfili, *et al.*, 2003)
	Oat (Slawko)	Germ, endospore	0.11 mg/100g	(Zielinski, *et al.*, 2001)
γ-T	Buckwheat	whole grain, hull, groat	10.1-22.10 mg/100g	(Sedej, *et al.*, 2012)
	Buckwheat Kora	whole grain	5.14 mg/100g	(Zielinski, *et al.*, 2001)
	Buckwheat Kora	endosperm with embryo	6.04 mg/100g	(Zielinski, *et al.*, 2001)
	Buckwheat Mancan variety	seed	10.56 mg/100g	(Przybylski, *et al.*, 1998)
	Oat (12 cultivars)[b]	Germ, endosperm, bran	0.05-0.12 mg/100g[c]	(D.M. Peterson & Qureshi, 1993)
	Oat (unspecified) [d]	Germ, endospore, bran	0.04 mg/100g	(Panfili, *et al.*, 2003)
	Oat (BDMY6, BDMY7, Che-chois, Y2330)	Germ, endosperm, bran, hull	0.03-0.36 mg/100g	(Musa Ozcan, *et al.*, 2006)
δ- T	Buckwheat Kora	whole grain	0.24 mg/100g	(Zielinski, *et al.*, 2001)
	Buckwheat	endosperm with embryo	0.22 mg/100g	(Zielinski, *et al.*, 2001)

	Kora			
	Buckwheat Mancan variety	seed,	3.64 mg/100g	(Przybylski*, et al.*, 1998)
	Buckwheat	whole grain, hull, groat	0.37-0.46 mg/100g	(Sedej*, et al.*, 2012)

[e]Expressed originally as micrograms per gram, converted to milligram per 100g

Supplemental table 3. Phytosterols, polysaccharides and fatty acids in oat and buckwheat				
Phytosterols				
Compound	Plant (cultivar)	Plant part	Concentration	Author
Total sterols	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	61.8-68.2 mg/100g[a]	(Horbowicz & Obendorf, 1992)
	Oat (Elin, Freja, Galopp, Matilda, Strok, Stormogul, Vital)	Germ, endosperm, bran, hull	35-49.1 mg/100g	{Maatta, 1999 #83}
	Common Buckwheat	Hulls, Groat	19-139 mg/100g	(Dziedzic, *et al.*, 2018)
	Buckwheat	Flour	99 mg/100g	{Bacchetti, 2011 #189}
Stanols, %	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	1.3-1.6 mg/100g[a]	(Shewry, *et al.*, 2008)
stanols	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	1.3-1.6 mg/100g[a]	(Shewry, *et al.*, 2008)
sitosterol	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	36.5-44.2mg/100g[a]	(Shewry, *et al.*, 2008)
	Oat (Vatter)	Leaves	42.6%[b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, Endosperm, bran, hull	42.9% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ and endosperm	30.6% [b]	(Eichenberger, 1984)
	Oat (Elin, Freja, Galopp, Matilda, Strok, Stormogul, Vital)	Germ, endosperm, bran, hull	23.7-32.1 mg/100g	{Maatta, 1999 #83}
campesterol	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	5.0-6.2 mg/100g[a]	(Shewry, *et al.*, 2008)
	Oat (Vatter)	Leaves	Trace	(Eichenberger, 1984)
	Oat (Vatter)	Germ, Endosperm, bran, hull	Trace	(Eichenberger, 1984)
	Oat (Vatter)	Germ, endosperm	trace	(Eichenberger, 1984)
	Oat (Vatter)	Leaves	Trace	(Eichenberger, 1984)
	Oat (Vatter)	Germ, Endosperm, bran, hull	Trace	(Eichenberger, 1984)
	Oat (Vatter)	Germ, endosperm	trace	(Eichenberger, 1984)
	Oat (Elin, Freja, Galopp, Matilda, Strok, Stormogul, Vital)	Germ, endosperm, bran, hull	3.2-4.6 mg/100g	{Maatta, 1999 #83}
stigmasterol	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	2.2-3.6 mg/100g[a]	(Peng L., 2017)
	Oat (Vatter)	Leaves	28.4% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, Endosperm, bran, hull	3.9% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, endosperm	4.6% [b]	(Eichenberger, 1984)
	Oat (Elin, Freja, Galopp, Matilda, Strok, Stormogul, Vital)	Germ, endosperm, bran, hull	1.1-2.1 mg/100g	{Maatta, 1999 #83}
Δ^7- stigmasterol	Oat (Vatter)	Leaves	1.7% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, Endosperm, bran, hull	1.0% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, endosperm	2.0% [b]	(Eichenberger, 1984)
stigmastanol	Oat (Vatter)	Leaves	0.8%	(Eichenberger, 1984)
lophenol	Oat (Vatter)	Leaves	1.8%	(Eichenberger, 1984)
	Oat (Vatter)	Germ, Endosperm, bran, hull	---	(Eichenberger, 1984)
	Oat (Vatter)	Germ, endosperm	0.6%	(Eichenberger, 1984)
Δ^5-avenasterol	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	2.4- 3.4 mg/100g[a]	
	Oat (Vatter)	Leaves	2.4% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, Endosperm, bran, hull	26.1% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, endosperm	23.2% [b]	(Eichenberger, 1984)
	Oat (Elin, Freja, Galopp, Matilda, Strok, Stormogul, Vital)	Germ, endosperm, bran, hull	1.5-4.7 mg/100g	{Maatta, 1999 #83}
Δ^7-avenastenol	Oat (Cacko, MV-Pehely, Fengli, Expander, Bajka)	Germ, endosperm, bran, hull (except for naked Cacko)	0.8- 1.2 mg/100g[a]	(Shewry, *et al.*, 2008)
	Oat (Vatter)	Leaves	1.7% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, Endosperm, bran, hull	0.6% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, endosperm	9.0% [b]	(Eichenberger, 1984)
cholestanol	Oat (Vatter)	Leaves	2.9% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, Endosperm, bran, hull	Trace	(Eichenberger, 1984)
	Oat (Vatter)	Germ, endosperm	0.4% [b]	(Eichenberger, 1984)
Δ^7-cholestenol	Oat (Vatter)	Leaves	1.7% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, Endosperm, bran, hull	0.6% [b]	(Eichenberger, 1984)
	Oat (Vatter)	Germ, endosperm	0.9% [b]	(Eichenberger, 1984)
*Cacko is a naked oat variety with high protein content. It has a high soluble dietary fibre (including β-glucan) content, but it is also sensitive to the environment and may give lower yields than other cultivars. Bajka is an intensive type with good protein content and seed yield. Expander is also an intensive type with good yield and is less sensitive to environmental effects. MV-Pehely has high protein content, whereas Fengli is a tall type. **total phenolics as galic acid equivalents *** Total phenol (gallic acid equivalent) and flavonoid (quercetin equivalent) contents were determined using Folin–Ciocalteau and aluminum chloride reagents, respectively				

**** catechin equivalents
[a]Original units converted from microgram/gram to milligram/100g ((A.R. Gulpinar, *et al.*, 2011))
[b]Expressed in percent (%) of the total sterol extracted

Polysaccharides				
Compound	Plant	Species/ cultivars	Concentration	Author
Total fagopyritols	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	128.2-962.1mg/100g	(Steadman, *et al.*, 2001)
fagopyritol A1	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	12.4-235.8 mg/100g	(Steadman, *et al.*, 2001)
fagopyritol A2	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	9.2-101.5mg/100g	(Steadman, *et al.*, 2001)
fagopyritol A3	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	11.1-65.8 mg/100g	(Steadman, *et al.*, 2001)
fagopyritol B1	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	78.9-1510.7 mg/100g	(Steadman, *et al.*, 2001)
fagopyritol B2	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	16.7-84.5 mg/100g	(Steadman, *et al.*, 2001)
fagopyritol B3	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	trace	(Steadman, *et al.*, 2001)
Fagopyritols	Buckwheat	bran	2600mg/100g	(Brindzova, *et al.*, 2008)
Total fagopyritols	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	176.4-2774.5 mg/100g	(Steadman, *et al.*, 2001)
fagopyritol A1	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	18.8-327.5mg/100g	(Steadman, *et al.*, 2001)
fagopyritol A2	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	14.2-188.8mg/100g	(Steadman, *et al.*, 2001)
fagopyritol A3	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	11.2-92.3mg/100g	(Steadman, *et al.*, 2001)
fagopyritol B1	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	115.7mg/100g-2004 mg/100g	(Steadman, *et al.*, 2001)
fagopyritol B2	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	16.5-216mg/100g	(Steadman, *et al.*, 2001)
fagopyritol B3	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	trace	(Steadman, *et al.*, 2001)
D-chiro-inositol	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	15.4-161.7mg/100g	(Steadman, *et al.*, 2001)
D-chiro-inositol	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	6.9-82.1mg/100g	(Steadman, *et al.*, 2001)
amylopectin	Buckwheat	Starch	75000 mg/100g	(Qin, *et al.*, 2010 ; Takahama & S., 2010)
myo-inositol	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	8.4-88.1mh/100g	(Steadman, *et al.*, 2001)
myo-inositol	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	3.3-40.5 mg/100g	(Steadman, *et al.*, 2001)
galactinol	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	5.2-70.4mg/g	(Steadman, *et al.*, 2001)
galactinol	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	3.5-36.5mg/100g	(Steadman, *et al.*, 2001)
sucrose	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	392.6-2463.5mg/100g	(Steadman, *et al.*, 2001)
sucrose	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	223-3876.3mg/100g	(Steadman, *et al.*, 2001)
α-galactosides	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Groats	37-44%	(Steadman, *et al.*, 2001)
α-galactosides	Buckwheat	Buckwheat (Cv. Manor) Milling Fractions from Whole Achenesa	38-42%	(Steadman, *et al.*, 2001)
amylose	Buckwheat	starch	25000 mg/100g	(Qin, *et al.*, 2010; Takahama & S., 2010)
Phytic acid	Buckwheat	bran	3500-	(Sterna, *et al.*, 2014);

			3800mg/100 g	
Glucan	Oat (unspecified)[b]	Germ, endosperm, bran	6.3g/60g of starch	(Regand, *et al.*, 2011)
Beta glucan	Oat		3.9%	(Kourimska, *et al.*, 2018)
	Oat	flour	0.5-5.6%	(Van den Broeck, *et al.*, 2015)
	Oat (Cacko)	Germ, endosperm	1.09% [a]	(Shewry, *et al.*, 2008)
	Oat (MV-Pehely)	Germ, endosperm	1.12% [a]	(Shewry, *et al.*, 2008)
	Oat (Fengli)	Germ, endosperm	1.03% [a]	(Shewry, *et al.*, 2008)
	Oat (Expander)	Germ, endosperm	1.03% [a]	(Shewry, *et al.*, 2008)
	Oat (Bajka)	Germ, endosperm	0.96% [a]	(Shewry, *et al.*, 2008)
	Oat (Cacko)	Bran	8.33% [a]	(Shewry, *et al.*, 2008)
	Oat (MV-Pehely)	Bran	8.09% [a]	(Shewry, *et al.*, 2008)
	Oat (Fengli)	Bran	6.20% [a]	(Shewry, *et al.*, 2008)
	Oat (Expander)	Bran	8.18% [a]	(Shewry, *et al.*, 2008)
	Oat (Bajka)	Bran	8.39% [a]	(Shewry, *et al.*, 2008)
	Oat (Cacko)	Germ, endosperm, bran	5.5% [a]	(Shewry, *et al.*, 2008)
	Oat (MV-Pehely)	Germ, endosperm, bran	5.6% [a]	(Shewry, *et al.*, 2008)
	Oat (Fengli)	Germ, endosperm, bran	4.5% [a]	(Shewry, *et al.*, 2008)
	Oat (Expander)	Germ, endosperm, bran	5.1% [a]	(Shewry, *et al.*, 2008)
	Oat (Bajka)	Germ, endosperm, bran	5.3% [a]	(Shewry, *et al.*, 2008)
	Oat (Cyril)	Germ, endosperm, bran	28 200 mg/100 g	(Hozova, *et al.*, 2007)
	Oat (Jakub)	Germ, endosperm, bran	5 180 mg/100 g	(Hozova, *et al.*, 2007)
	Oat (unspecified)	Groat	4.1-5.7%	(Sowa & White, 1992)
	Buckwheat Fagopyrum	Whole grain	1 260 mg/100g	(Hozova, *et al.*, 2007)
Fatty acids				
Total fatty acids	Buckwheat	bran	11000mg/100 g	(Steadman, *et al.*, 2001)
	Buckwheat	embryo	8.2%[a]	(Dorrell, 1971)
	Buckwheat	endosperm	0.4%[a]	(Dorrell, 1971)
	Buckwheat	testa	2.0%[a]	(Dorrell, 1971)
	Buckwheat	pericarp	0.5%[a]	(Dorrell, 1971)
	Common Buckwheat	Whole seed, hulls, bran, flour	288-5429mg/100g	(Sinkovic, *et al.*, 2020)
	Tartary Buckwheat	Whole seed, hulls, bran, flour	294-6264 mg/100g	(Sinkovic, *et al.*, 2020)
C14:0	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Flour	11-12.4 mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Bran	23-23.4 mg/100g	(Peng L., 2017)
	Common Buckwheat	Embryo, Endosperm	0.3-14.9% [a]	(Horbowicz & Obendorf, 1992)
	Common Buckwheat	Whole seed, hulls, bran, flour	14-157 mg/100g	(Sinkovic, *et al.*, 2020)
	Tartary Buckwheat	Whole seed, hulls, bran, flour	14-81mg/100g	(Sinkovic, *et al.*, 2020)
	Common Buckwheat	grains	530-800mg/100g	(Golijan, *et al.*, 2019)
	Tartary Buckwheat	whole seed	0.1-0.5%[a]	(Dorrell, 1971)
	Tartary Buckwheat	embryo	10.8-17.4% [a]	(Dorrell, 1971)
	Tartary Buckwheat	endosperm	14.9-20% [a]	(Dorrell, 1971)
	Tartary Buckwheat	testa	10.4-18.2% [a]	(Dorrell, 1971)
	Tartary Buckwheat	pericarp	11% [a]	(Dorrell, 1971)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Flour	184.2-238.9 mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Bran	380.6-423.8 mg/100g	(Peng L., 2017)
	Common Buckwheat	Embryo, Endosperm	13.1-70.5% [a]	(Horbowicz & Obendorf, 1992)
	Common Buckwheat/Tartary Buckwheat	Seed	17.1-18.6% [a]	(Tsuzuki, *et al.*, 1991)
	Common Buckwheat	Whole seed, hulls, bran, flour	1473-2642 mg/100g	(Sinkovic, *et al.*, 2020)
	Tartary Buckwheat	Whole seed, hulls, bran, flour	1386-2434	(Sinkovic, *et al.*, 2020)

			mg/100g	
	Common Buckwheat	grains	18600-2401 mg/100g	(Golijan, *et al.*, 2019)
C18:0	Common Buckwheat	grains	4400-5090 mg/100g	(Golijan, *et al.*, 2019)
	Tartary Buckwheat	whole seed	2-2.4% [a]	(Dorrell, 1971)
	Tartary Buckwheat	embryo	1.6-2.2% [a]	(Dorrell, 1971)
	Tartary, Buckwheat	endosperm	2.2-3.7% [a]	(Dorrell, 1971)
	Tartary, Buckwheat	testa	2.2.-2.8% [a]	(Dorrell, 1971)
	Tartary, Buckwheat	pericarp	2.5-5% [a]	(Dorrell, 1971)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Flour	67.4-100.4 mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Bran	105.4-125.4 mg/100g	(Peng L., 2017)
	Common Buckwheat	Embryo, Endosperm	2.6-5.3% [a]	(Horbowicz & Obendorf, 1992)
	Common Buckwheat/ Tartary Buckwheat	Seed	1.89-2.05% [a]	(Tsuzuki, *et al.*, 1991)
	Common Buckwheat	Whole seed, hulls, bran, flour	167-336 mg/100g	(Sinkovic, *et al.*, 2020)
	Tartary Buckwheat	Whole seed, hulls, bran, flour	193-499 mg/100g	(Sinkovic, *et al.*, 2020)
	Tartary Buckwheat	whole seed	32.5-38.5% [a]	(Dorrell, 1971)
	Common Buckwheat	grains	52020-53420 mg/100g	(Golijan, *et al.*, 2019)
	Tartary Buckwheat	embryo	33.2-40.5% [a]	(Dorrell, 1971)
	Tartary,Buckwheat	endosperm	31-35.5% [a]	(Dorrell, 1971)
	Tartary,Buckwheat	testa	28.7-33.9% [a]	(Dorrell, 1971)
	Tartary, Buckwheat	pericarp	14.6-19.6% [a]	(Dorrell, 1971)
	Common Buckwheat/Tartary Buckwheat	Seed	35.9-36.7% [a]	(Tsuzuki, *et al.*, 1991)
	Common Buckwheat	Embryo, Endosperm	6.1-33.7% [a]	(Horbowicz & Obendorf, 1992)
	Common Buckwheat	Whole seed, hulls, bran, flour	2096-3647mg/100g	(Sinkovic, *et al.*, 2020)
	Tartary Buckwheat	Whole seed, hulls, bran, flour	2620-4076 mg/100g	(Sinkovic, *et al.*, 2020)
C18:1	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Flour	264.7-283.9 mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Bran	547.2-722.2 mg/100g	(Peng L., 2017)
	Common Buckwheat	grains	32740-53420 mg/100g	(Golijan, *et al.*, 2019)
C18:2	Common Buckwheat	grains	9330-12040mg/100g	(Golijan, *et al.*, 2019)
	Common Buckwheat	Embryo,Endosperm	1.9-49.6% [a]	(Horbowicz & Obendorf, 1992)
	Common Buckwheat/Tartary Buckwheat	Seed	34.4-36.9% [a]	(Tsuzuki, *et al.*, 1991)
	Tartary, Buckwheat	whole seed	30.9-34.7% [a]	(Dorrell, 1971)
	Tartary Buckwheat	embryo	32.4-36.8% [a]	(Dorrell, 1971)
	Tartary Buckwheat	endosperm	16.8-33% [a]	(Dorrell, 1971)

	Tartary Buckwheat	, testa	27.6-32.7% [a]	(Dorrell, 1971)
	Tartary Buckwheat	, pericarp	13-25.7% [a]	(Dorrell, 1971)
	Common Buckwheat	Whole seed, hulls, bran, flour	3723-4757 mg/100g	(Sinkovic, *et al.*, 2020)
	Tartary Buckwheat	Whole seed, hulls, bran, flour	3554-4490mg/100g	(Sinkovic, *et al.*, 2020)
C18:2n-6c	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Flour	258.3-329.9 mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Bran	793-1032.4 mg/100g	(Peng L., 2017)
C18:3n-3	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Flour	21.9-26.1mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Bran	38.4-49.4mg/100g	(Peng L., 2017)
C18:3	Common Buckwheat	grains	5340-6740 mg/100g	(Golijan, *et al.*, 2019)
	Tartary Buckwheat	, whole seed	3.2-6-2% [a]	(Dorrell, 1971)
	Tartary Buckwheat	, embryo	2.4-6.5% [a]	(Dorrell, 1971)
	Tartary Buckwheat	, endosperm	2.6-5.7% [a]	(Dorrell, 1971)
	Tartary Buckwheat	, testa	4.4-6-4% [a]	(Dorrell, 1971)
	Tartary Buckwheat	, pericarp	2.9-4.2% [a]	(Dorrell, 1971)
	Common Buckwheat/Tartary Buckwheat	Seed	1.56-2.24%[a]	(Tsuzuki, *et al.*, 1991)
	Common Buckwheat	Embryo, Endosperm	1.1-12.9% [a]	(Horbowicz & Obendorf, 1992)
	Common Buckwheat	Whole seed, hulls, bran, flour	221-578 mg/100g	(Sinkovic, *et al.*, 2020)
	Tartary Buckwheat	Whole seed, hulls, bran, flour	168-360mg/100g	(Sinkovic, *et al.*, 2020)
C20:0	Common Buckwheat	grains	2720-3380 mg/100g	(Golijan, *et al.*, 2019)
	Tartary Buckwheat	whole seed	1.5-2.2% [a]	(Dorrell, 1971; A.R. Gulpinar, *et al.*, 2011)
	Tartary Buckwheat	embryo	1.1-1.6% [a]	(Dorrell, 1971)
	Tartary Buckwheat	endosperm	1.1-3-1% [a]	(Dorrell, 1971)
	Tartary Buckwheat	testa	1-3.3% [a]	(Dorrell, 1971)
	Tartary Buckwheat	pericarp	3.3-5-3% [a]	(Dorrell, 1971)
	Common Buckwheat/ Tartary Buckwheat	Seed	1.13-1.40% [a]	(Tsuzuki, *et al.*, 1991)
	Common Buckwheat	Embryo, Endosperm	1.1-2.4% [a]	(Horbowicz & Obendorf, 1992)
	Common Buckwheat	Whole seed, hulls, bran, flour	184-304 mg/100g	(Sinkovic, *et al.*, 2020)
	Tartary Buckwheat	Whole seed, hulls, bran, flour	113-203 mg/100g	(Sinkovic, *et al.*, 2020)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Flour	15.2-16.5 mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Bran	34.4-35.6 mg/100g	(Peng L., 2017)
	Common Buckwheat	grains	0190-360 mg/100g	(Golijan, *et al.*, 2019)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Flour	8.8-12.1 mg/100g	(Peng L., 2017)
	Tartary Buckwheat Chuanqiao 1&2, Xiqiao 3	Bran	26.0-31.8 mg/100g	(Peng L., 2017)

	Common Buckwheat	Embryo, Endosperm	1.1-3.6% [a]	(Horbowicz & Obendorf, 1992)
	Common Buckwheat/ Tartary Buckwheat	Seed	2.12-2.95% [a]	(Tsuzuki, *et al.*, 1991)
C22:1	Tartary Buckwheat	Seed	0.500 mg/100g	Tsuzuki, *et al.*, 1991)
C22:0	Tartary Buckwheat	, whole seed	1.1-2.2% [a]	(Dorrell, 1971)
	Tartary Buckwheat	, embryo	0.8-1.7% [a]	(Dorrell, 1971)
	Tartary Buckwheat	, endosperm	0.9-2.4% [a]	(Dorrell, 1971)
	Tartary Buckwheat	, testa	1.2-4% [a]	(Dorrell, 1971)
	Tartary Buckwheat	, pericarp	0.1-6.2% [a]	(Dorrell, 1971)
	Common Buckwheat	Embryo, Endosperm	0.9-2.8% [a]	(Horbowicz & Obendorf, 1992)
	Common Buckwheat/Tartary Buckwheat	Seed	1.06-1.44%[a]	(Tsuzuki, *et al.*, 1991)
	Common Buckwheat	grains	250 mg/100g	(Golijan, *et al.*, 2019)
	Common Buckwheat/Tartary Buckwheat	Seed	0.18-0.52% [a]	(Tsuzuki, *et al.*, 1991)
	Common Buckwheat/Tartary Buckwheat	Seed	0.60-0.91% [a]	(Tsuzuki, *et al.*, 1991)
1,2 diacylglycerol	Oat (33 wild species)	Germ, endosperm, bran	1.5, %[b]	(Leonova, *et al.*, 2008)
	Oat (10 cultivated species)	Germ, endosperm, bran	1.1, % [b]	(Leonova, *et al.*, 2008)
1,3 diacylglycerol	Oat (33 wild species)	Germ, endosperm, bran	2.2, % [b]	(Leonova, *et al.*, 2008)
	Oat (10 cultivated species)	Germ, endosperm, bran	2.3, % [b]	(Leonova, *et al.*, 2008)
Free fatty acid	Oat (33 wild species)	Germ, endosperm, bran	1.6, % [b]	(Leonova, *et al.*, 2008)
	Oat (10 cultivated species)	Germ, endosperm, bran	2.4, % [b]	(Leonova, *et al.*, 2008)
	Oat	Groat, bran, endosperm, scutellum, embrioni	2-5%	(Youngs, 1978)
TAG1	Oat (wild species)	Germ, endosperm, bran	1.2, % [b]	(Leonova, *et al.*, 2008)
	Oat (cultivated species)	Germ, endosperm, bran	1.4, % [b]	(Leonova, *et al.*, 2008)
	Common buckwheat	grain	9.94-29.69 %	(Golijan, *et al.*, 2019)
TAG2	Oat (wild species)	Germ, endosperm, bran	0.9, % [b]	(Leonova, *et al.*, 2008)
	Oat (cultivated species)	Germ, endosperm, bran	1.1, % [b]	(Leonova, *et al.*, 2008)
Total Triacylglycerol	Oat (wild species)	Germ, endosperm, bran	77.1, % [b]	(Leonova, *et al.*, 2008)
	Oat (cultivated species)	Germ, endosperm, bran	74.2, % [b]	(Leonova, *et al.*, 2008)
	Oat (15 cultivars)	Groat, bran, endosperm, scutellum, embrioni	39-58%	(Youngs, 1978)
Myristic (C14:0)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	0.5-0.7%	(Kourimska, *et al.*, 2018)
	Oat (Laima, Arta, St.Līva, St.Dārta)	Germ, endosperm, bran, hull	0.2%	(Sterna, *et al.*, 2014)
	Oat (15 cultivars)	Groat, bran, endosperm, scutellum, embrioni	0.4-0.8%	
	Oat (9 cultivars)	Germ, endosperm, bran, +/-hull	0.2-0.3%	(Brindzova, *et al.*, 2008)
Palmitic (C16:0)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, hull	21.4-22.8%	(Kourimska, *et al.*, 2018)
	Oat	flour	31.8- 262.3 mg/100g	(Van den Broeck, *et al.*, 2015)
	Common Buckwheat	Seeds	13.5%	(A. R. Gulpinar, *et al.*, 2012)

	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, hull	16.1-17.1%	(Sterna, *et al.*, 2014)
	Oat (S-156, 33793)	Germ, endosperm, bran	15.5-17.4%	(Sterna, *et al.*, 2014)
	Oat (15 cultivars)	Groat, bran, endosperm, scutellum, embrioni	16.1-21.8%	(Youngs, 1978)
	Oat (Astor, Maldwyn, C 5020, C5027, C5031, Nuprime)	Germ, endosperm, bran, +/-hull	16.6-21.7%	(Welch, 1975)
	Oat (9 cultivars)	Germ, endosperm, bran, +/-hull	13.8-17.2%	(Brindzova, *et al.*, 2008)
	Oat (Freja, Matilda)	Germ, endosperm, bran, hull	12.0-16.1%	(Banas, *et al.*, 2007)
	Oat (Freja, Matilda)	Emrbyo and scutellum	14.0-20.9%	(Banas, *et al.*, 2007)
	Oat (BDMY6, BDMY7, Che-chois, Y2330)	Germ, endosperm, bran, hull	15.7-18.8%	(Musa Ozcan, *et al.*, 2006)
Palmitoleic (C16:1 cis-9)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	0.2-0.3%	(Kourimska, *et al.*, 2018)
	Oat (9 cultivars)	Germ, endosperm, bran, +/-hull	0.2-0.3%	(Brindzova, *et al.*, 2008)
Stearic (C18:0)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	1.5-3-1%	(Kourimska, *et al.*, 2018)
	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, hull	1.7-2.5%	(Sterna, *et al.*, 2014)
	Oat	flour	7.6-33.3 mg/100g	(Van den Broeck, *et al.*, 2015)
	Common Buckwheat	Seeds	1.62%	(A. R. Gulpinar, *et al.*, 2012)
	Oat (S-156, 33793)	Germ, endosperm, bran	1.7-2.4%	(Sterna, *et al.*, 2014)
	Oat (15 cultivars)	Groat, bran, endosperm, scutellum, embrioni	1.2-2%	(Youngs, 1978)
	Oat (Astor, Maldwyn, C 5020, C5027, C5031, Nuprime)	Germ, endosperm, bran, +/-hull	1.05-2.18%	(Welch, 1975)
	Oat (9 cultivars)	Germ, endosperm, bran, +/-hull	1.3-2.2%	(Brindzova, *et al.*, 2008)
	Oat (Freja, Matilda)	Germ, endosperm, bran, hull	0.5-2.6%	(Banas, *et al.*, 2007)
	Oat (Freja, Matilda)	Emrbyo and scutellum	0.4-0.9%	(Banas, *et al.*, 2007)
	Oat (BDMY6, BDMY7, Che-chois, Y2330)	Germ, endosperm, bran, hull	2.79%	(Musa Ozcan, *et al.*, 2006)
Oleic (C18:1)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, hull	36.2-37.8%	(Sterna, *et al.*, 2014)
	Oat (S-156, 33793)	Germ, endosperm, bran	37.9-40.4%	(Sterna, *et al.*, 2014)
	Oat (Freja, Matilda)	Germ, endosperm, bran, hull	17.3-51.6%	(Banas, *et al.*, 2007)
	Oat (Freja, Matilda)	Emrbyo and scutellum	30.5-43.0%	(Banas, *et al.*, 2007)
	Oat (BDMY6, BDMY7, Che-chois, Y2330)	Germ, endosperm, bran, hull	33.97-51.26%	(Musa Ozcan, *et al.*, 2006)
	Common Buckwheat	Seeds	33.15%	(A. R. Gulpinar, *et al.*, 2012)
Elaidic (C18:1trans-9)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	0.1-0.5%	(Kourimska, *et al.*, 2018)
Oleic (C18:1 cis-9)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	30.7-32.2%	(Kourimska, *et al.*, 2018)
	Oat (15 cultivars)	Groat, bran, endosperm, scutellum, embrioni	28.4-40.3%	(Youngs, 1978)

	Oat (Astor, Maldwyn, C 5020, C5027, C5031, Nuprime)	Germ, endosperm, bran, +/-hull	22.0-32.5%	(Welch, 1975)
	Oat (9 cultivars)	Germ, endosperm, bran, +/-hull	33.4-42.2%	(Brindzova*, et al.*, 2008)
	Oat	flour	113.7- –723.3 mg/100g	(Van den Broeck*, et al.*, 2015)
Cis-13-Octadecenoic (C18:1 cis-13)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	1.5-1.8%	(Kourimska*, et al.*, 2018)
Linoleic (C18:2)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, hull	1-1.2%	(Sterna*, et al.*, 2014)
	Oat	flour	1.2-17.1 mg/100g	(Van den Broeck*, et al.*, 2015)
	Oat (S-156, 33793)	Germ, endosperm, bran	0.9-1.2%	(Sterna*, et al.*, 2014)
	Oat (Astor, Maldwyn, C 5020, C5027, C5031, Nuprime)	Germ, endosperm, bran, +/-hull	44.4-50.3%	(Welch, 1975)
	Oat (9 cultivars)	Germ, endosperm, bran, +/-hull	34.4-42.7%	(Brindzova*, et al.*, 2008)
	Oat (Freja, Matilda)	Germ, endosperm, bran, hull	29.9-47.0%	(Banas*, et al.*, 2007)
	Oat (Freja, Matilda)	Emrbyo and scutellum	34.6-45.6%	(Banas*, et al.*, 2007)
	Oat (BDMY6, BDMY7, Che-chois, Y2330)	Germ, endosperm, bran, hull	22.8-35.9%	(Musa Ozcan*, et al.*, 2006)
	Common Buckwheat	Seeds	31.93%	(A. R. Gulpinar*, et al.*, 2012)
C18:2 (n-6)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, hull	39.4-41.6%	(Sterna*, et al.*, 2014)
	Oat (S-156, 33793)	Germ, endosperm, bran	38.4-39.1%	(Sterna*, et al.*, 2014)
Linoelaidic trans (C18:2 trans,trans-9,12)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	<0.1-0.4%	(Kourimska*, et al.*, 2018)
Linoelaidic cis (C18:2 *cis,cis*-9,12)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	34.6-38.2%	(Kourimska*, et al.*, 2018)
	Oat (15 cultivars)	Groat, bran, endosperm, scutellum, embrioni	36.6-45.8%	(Youngs, 1978)
Linolenic (C18:3)	Oat (15 cultivars)	Groat, bran, endosperm, scutellum, embrioni	1.5-2.5%	(Youngs, 1978)
	Oat (Astor, Maldwyn, C 5020, C5027, C5031, Nuprime)	Germ, endosperm, bran, +/-hull	1.89-3.38%	(Welch, 1975)
	Oat (9 cultivars)	Germ, endosperm, bran, +/-hull	1.1-1.9%	(Brindzova*, et al.*, 2008)
	Oat (Freja, Matilda)	Germ, endosperm, bran, hull	1.0-20.2%	(Banas*, et al.*, 2007)
	Oat (Freja, Matilda)	Emrbyo and scutellum	2.0-5.3%	(Banas*, et al.*, 2007)
	Oat (BDMY6, BDMY7, Che-chois, Y2330)	Germ, endosperm, bran, hull	0.64%	(Musa Ozcan*, et al.*, 2006)
Linolenic (C18:3 (n-3))	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, hull	0.9-1.3%	(Sterna*, et al.*, 2014)
	Oat (S-156, 33793)	Germ, endosperm, bran	0.9-1.1%	(Sterna*, et al.*, 2014)
Alpha-Linolenic (C18:3 all cis 9,12,15)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	1.2-1.6%	(Kourimska*, et al.*, 2018)
Linolenic (C18:3) isomers	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	0.1-0.4%	(Kourimska*, et al.*, 2018)

Arachidic (C20:0)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	0.2-0.4%	(Kourimska, *et al.*, 2018)
	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, hull	0.2%	(Sterna, *et al.*, 2014)
	Oat (S-156, 33793)	Germ, endosperm, bran	0.2%	(Sterna, *et al.*, 2014)
Paullinic (C20:1)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, hull	0.6-0.8%	(Sterna, *et al.*, 2014)
	Oat (S-156, 33793)	Germ, endosperm, bran	0.7%	(Sterna, *et al.*, 2014)
	Oat (9 cultivars)	Germ, endosperm, bran, +/-hull	0.8-1.0%	(Brindzova, *et al.*, 2008)
	Oat (Freja, Matilda)	Germ, endosperm, bran, hull	0.7-1.2%	(Banas, *et al.*, 2007)
	Oat (Freja, Matilda)	Emrbyo and scutellum	0.7-1.7%	(Banas, *et al.*, 2007)
Eicosapentanoic (C20:5)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, hull	0.2-0.4%	(Sterna, *et al.*, 2014)
	Oat (S-156, 33793)	Germ, endosperm, bran	0.2-0.3%	(Sterna, *et al.*, 2014)
Gondoic (C20:1 cis-11)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	0.8-1.1%	(Kourimska, *et al.*, 2018)
Eicosadienoic (C20:2 cis,cis-11,14)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	<0.1-1.5%	(Kourimska, *et al.*, 2018)
Behenic (C22:0)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	0.3-0.9%	(Kourimska, *et al.*, 2018)
	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, hull	0.1%	(Sterna, *et al.*, 2014)
	Oat (S-156, 33793)	Germ, endosperm, bran	0.1%	(Sterna, *et al.*, 2014)
Erucic (C22:1 cis-13)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	<0.1-0.1%	(Kourimska, *et al.*, 2018)
Lignoceric (C24:0)	Oat (Raven, Cavaliere, Korok, Kertag, Kamil, Patrik)	Germ, endosperm, bran, +/-hull	0.3-0.5%	(Hamberg, *et al.*, 1998)
Avenoleic acid	Oat (Vital)	Germ, endosperm, bran, hull (Eluent choloroform)	29%[c]	(Hamberg, *et al.*, 1998)
	Oat (Vital)	Germ, endosperm, bran, hull (Eluent Acetone)	63% [c]	(Hamberg, *et al.*, 1998)
	Oat (Vital)	Germ, endosperm, bran, hull (Eluent Methanol)	8% [c]	(Hamberg, *et al.*, 1998)
Galactolipid –avenolate complex	Oat (Vital)	Germ, endosperm, bran, hull	0.5-0.6mg/g	(Hamberg, *et al.*, 1998)
Cholesterol	Oat (Vatter)	Leaves	12.8%	(Eichenberger, 1984)
	Oat (Vatter)	Germ, Endosperm, bran, hull	2.8%	(Eichenberger, 1984)
	Oat (Vatter)	Germ and endosperm	2.4%	(Eichenberger, 1984)
Saponins				
Avenacoside A	oat	grains	0.15-2.6 mg/100g	(Pecio, *et al.*, 2013)
	oat	kernel	0.008-0.03% DW	(Önning & Asp, 1993)
avenacoside B	oat	grains	0.06-2.51 mg/100g	(Pecio, *et al.*, 2013)
	oat	kernel	0.003-0.01% DW	(Önning & Asp, 1993)
26-desglucoavenacoside A	oat	grains	0.07-0.7 mg/100g	(Pecio, *et al.*, 2013)

Total avenacins	oat	roots	1280 mg/100g	(Mary & Crombie, 1986)
Total saponins	oat	Porridge	130 mg/100g	(Tschesche & Wulff, 1973)
	oat	Porridge	100 mg/100g	(Fenwick D. E, 1983)

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PRISMA CHECKLIST

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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	6
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplement
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	n.a.
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	n.a
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	n.a

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	n.a
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n.a
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	7
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	n.a
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	n.a.
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	n.a.
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	n.a.
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n.a.
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	7-17
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	17
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	18
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	19

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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*Declaration of Interest Statement

Declaration of interests

☐ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☒The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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